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MAY-JUNE, 1981

Vol. 11, No. 3

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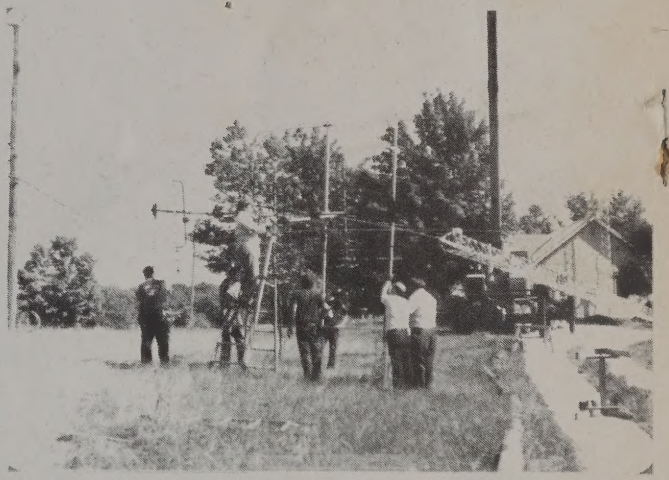

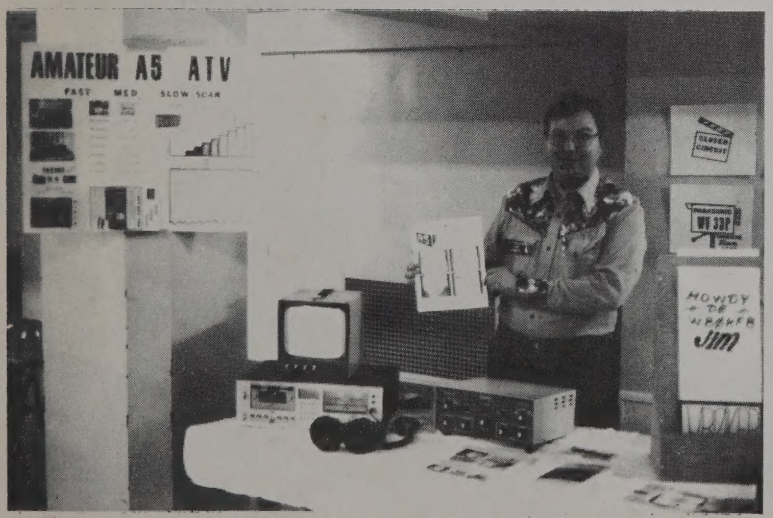

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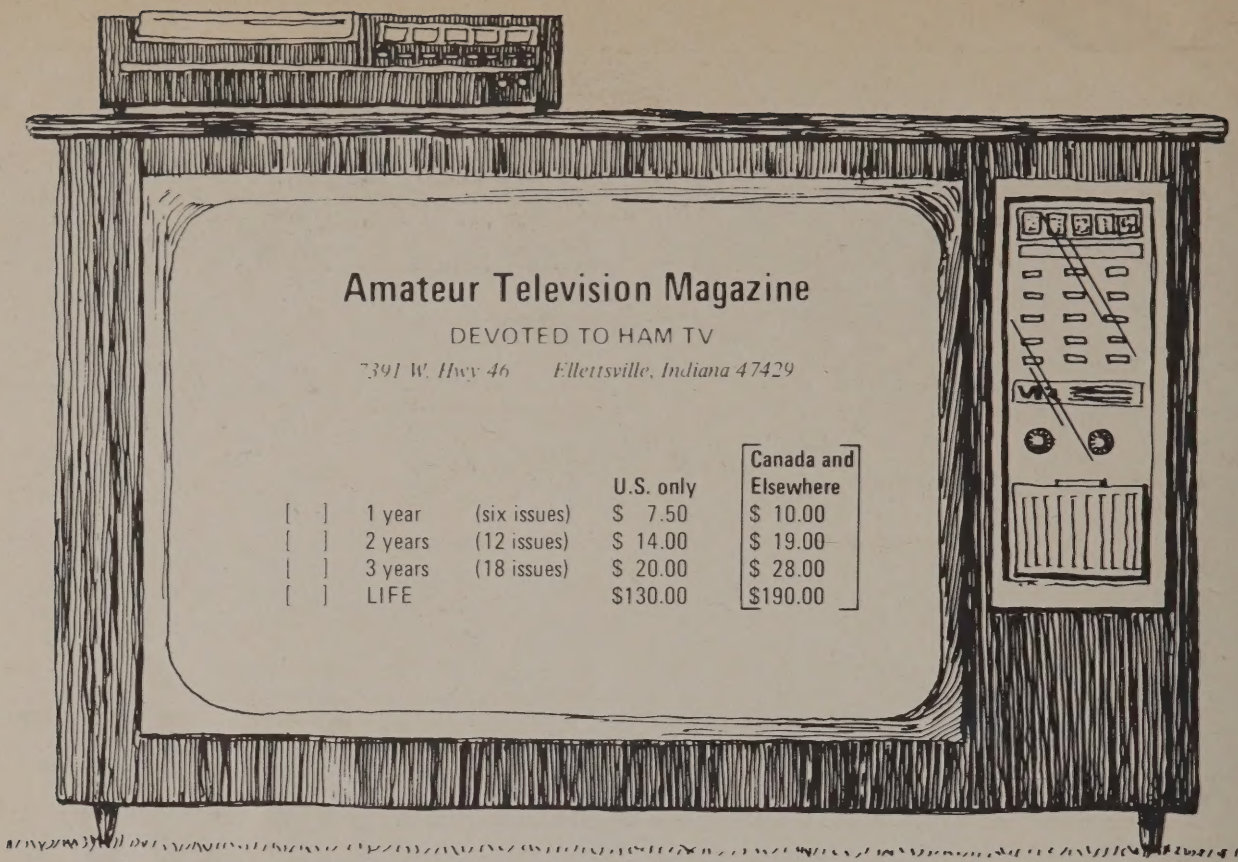

Amateur Television Magazine

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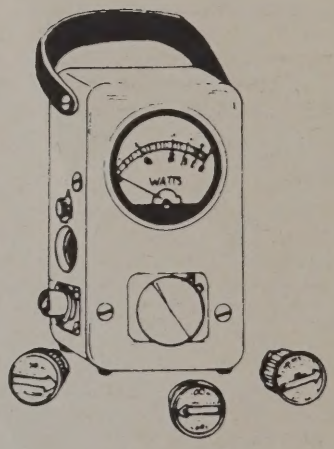

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Amateur Television Magazine
All correspondence to:
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SPREAD SPECTRUM STA ISSUED, and A5 WAS THERE.

At a special ceremony in Carlos Robert's office (chief of the personal radio branch of the FCC) the first Spread Spectrum STA was granted to members of AMRAD the amateur radio developmet club based in Washington, DC which also has members across the country. Once again, A5 was the only amateur publication present. Chris Imlay N3AKD a Washington DC attorney closely associated with the ARRL was also present when the first STA authorization letters were given to two representatives of AMRAD. The autorization allows experimental spread spectrum transmissions in nearly all amateur bands including UHF frequencies with only a few restrictions, mostly prior notification to government agencies which apparently have operations in ham bands in various states. A5 offers its congratualtions and well wishes to AMRAD in their quest of new frontiers.

EARLY RENEWAL will save you $1/yr for 1, 2 and 3 year renewals (save up to $3) is you renew before MAY 1, 1981. This is the may issue, so any subscriptions with a MAY 81 expiration line are now expired and JULY 81 subscribers, this is your next to last issue, so renew now.

Clay K4AEP has a computer program available for SSTV/RTTY so if you are interested give him an SASE for details.

Vince Luciani K2VJ would like to swap a TC-1005 RCA camera for an HF linear, RD 1 Box 111H Egg Harbour, NJ 08215

Congrats to Mike KC2Q winner of the A5 SSTV contest with 1500 points, 19 states, 9 countries, 41 mug shots, 3 continents. Mike is grand prize winner. Dan WBØWKQ was a close second with 1290 points, WAØOQA third with 805 points, HB9AYX fourth with 640 points and you scribe managed three hours operating time to rack up 5th place with 450 points. Some 200+ stations were noted on the logs submitted so activity was good, naturally we would like even more next year. Kindly send comments and suggestions to Mike Stone WBØQCD so that we can improve on the contest for next year.

Meanwhile, Japan is now sponsering FOUR SSTV contests per year (phew). JA1EKK Eigi sends the info: DATES: Sept 1 to Sept 30 1981 0000-2400 Jst. OR Aug 31 to Sept 29 1500-1500 GMT) (same period). All bands 80-3/4 mtrs.

LIMITS; Same station same band, only once per day, no crossband operations, single band per transmission (can't call CQ on two bands at once), no out of band operation.

Only two way QSO's count. RSV + actual power output, can be signed 599100 as 599 at 100 watts.

POINTS; 1 point per two way at each band

PULTIPLIERS: Japan JA1-JA0, JR6, JD1, 12 areas, countries per DXCC list except Japan, days worked limited to a count of 1 for each 24 hour period. FINAL SCORE QSO numbers x(areas + countries + days worked)

Send logs and SASE to: JSTA Office, c/o Masawo Mori JA1COW, 545-1 Ehara, Sukura-city, Chiba-Pref. 285 Japan. Deadline Oct 15th, 1981.

Thirty days...now that's a CONTEST!!!

Indy hamfest is July 12th. Canada has an ATV Repeater, VE2RTV with 10 watts in Montreal. Also an experimental beacon on 440 Mhz with the call VE2CUM. St. Louis, MO reports some new ATV stations, WDØFCH Earl and WBØZJP Dave. They are operating on 439.25 and looking for DX.

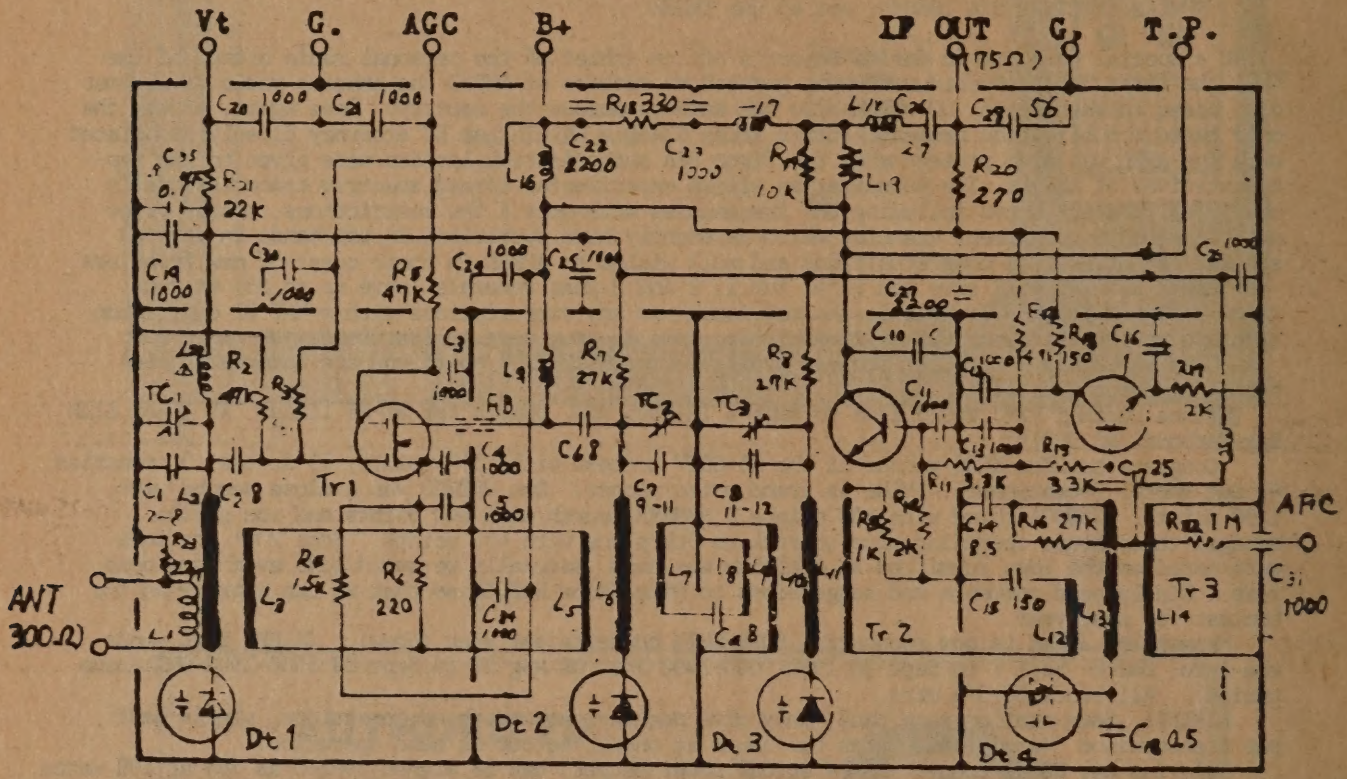
The next issue of A5 goes to press July 10th, so send in your news and articles today.

Your scribe is a little puzzeled. What ever happened to Don Miller W9NTP ARRL Director? It seems the votes were not even counted, though rumor has it he won by a large margin, and Metzger of Illinois was APPOINTED league director. I read nothing in QST to explain this, nor do I read anything in QST about what happened to Gordon West who was disqualified from the election because he writes a ham column in a CB magazine. Come on Newington, fess up, what kinda crap is this??? Its a shame that folks who are commercially involved in ham radio (even if you just write a book or column you are disqualified by ARRL rules) cannot be elected to League office. Obvously, the David Nurse (Heathkit) Dennis Had (Dentron) Peter Drake(R. L. Drake) Robert Burchfield (Tentec) 's of the world are what the ARRL needs for leadership. The League is a business, and needs business leadership to survive, grow and continue to forge a place for amateur radio in the spectrum spaces to come. Its time for a change in the rules to reflect the world business community of today, not the outmoded models of 1920 when aristocracy was herald. Today is big bux, influence, power and greed which rule the government. Ask any lobbist!!! We need to get out of the Newington Ivory Tower and get down to business in the grimy Washington DC QTH's. That's where the action IS!
I'm willing to run for director if someone out there will buy A5!

UHF VARACTOR TUNERS

The attached sheet describes the UHF VARACTOR tuner that we are presently shipping. Order it by our part #5690 @ $24.95 (plus 1.50 UPS). This is probably the most widely used tuner today.

For FRINGE AREA reception, order our SW/5695 UHF VARACTOR tuner at $34.95 (plus 1.50 UPS). Primary difference is it's 75 ohm input impedance, higher sensitivity and channel 3 output.



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RCA HI-VHF PWR AMP

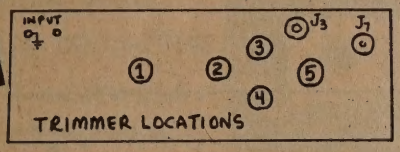
2 METER MODIFICATION & TUNE-UP FOR THE RCA-VHF AMPLIFIER.

We acquired these "black box" VHF Amplifiers as part of a larger buy of RCA Mobile Communication equipment. We are still waiting for documentation for these assemblies from RCA.
They appear to be part of a modular mobile system which permits packaging an assortment of mobile transceivers with different power output levels by choosing various power add-on packages. As supplied, they are tuned to cover the commercial 150-174 MHZ VHF band. No modification is necessary if used in this band. We sold a large number of these units at hamfests with-out instructions for modifying for 2 meters & received feed-back on how simple the mod. would be. Most seemed to be able to lower the frequency by just squeezing the coils & retuning the trimmers.

TUNE UP PROCEDURE.

We found the following steps worked:

(1) Input to this Power Amplifier must be limited to no more than 200 MW or the driver transistor (Q_1) will be DESTROYED.
(2) If you intend to drive it with a 1 watt H.T., open the jumper across R_9, the 47 ohm input resistor and add a 47 ohm resistor across R_5 (330 ohm). Input sensitivity of the amplifier is approximately 100 MW for maximum output and can be driven directly by a crystal oscillator.
(3) Without retuning or modification, the unit will immediately deliver approximately 2.5 Watts on 2 meters with 100 MW in.
(4) To increase the output on 2 meters, remove the 270 ohm resistor inside L_9 and the 1.5 K ohm resistor inside L_{10} (below C_{44}).
(5) Remove the large aluminum heat sink nut from Q_2 and the 6 screws that hold the P.C. board to the chassis. There are 2 metal/mica capacitors attached to the bottom of the board. Carefully unsolder the center conductor (with the hole) of the 20 MMF capacitor connected from the collector of Q_2 to ground. It is not necessary to remove the capacitor. Re-assemble chassis & heat sink & retune for maximum power.
(6) The #3 trimmer winds up pretty tight. Increasing the number of turns on L_8, will center the range.



RCA

6-8 WATTS OUT

SCIENCE WORKSHOP

This completes the modification and tune-up (as best as we know it now). Trimmer #5 & L_9 are shorted out by the switching diodes in the transmit mode (part of the Solid State T-R Switch) and probably should be adjusted for maximum received signal in the receive mode. Applying B+ to leads #8 forward biases both diodes in the TR Switch.
We would be most interested in applications you may have found for this low priced gem and will award a free unit for the best feed-back each month (as long as our supply lasts).

NEW SCIENCE WORKSHOP NEWS

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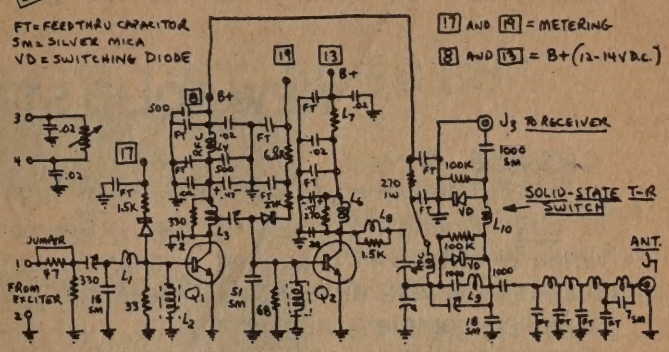

COMPARABLE CIRCUIT FROM THE VHF HANDBOOK

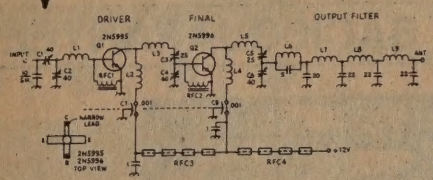

Fig. 11-28 – Schematic diagram of the 25-watt solid-state amplifier. Capacitors are disk ceramic unless otherwise noted.
C1, C2, C4, C6 – Compression trimmer.
C3, C5 – Air variable.
C7, C8 – Feedthrough type.
L1 – 1/4 X 2 1/2-inch copper strap.
L2, L4 – 9 turns No. 20 enam., closewound, 3/16-in. dia.
L3, L5 – 3 turns No. 14 tinned bus wire, 3/8-inch ID x 1/2-inch long.
L6 – 2 turns No. 20 enam., closewound, 1/4-inch dia.
L7-L9, incl. – 3 turns No. 20 enam., closewound, 1/4-inch dia.
Q1, Q2 – RCA power semiconductor, used with appropriate heat sink.
RFC1, RFC2 – 4 turns No. 30 enam. wound on a single ferrite bead (turns looped through the bead).
RFC3, RFC4 – Four ferrite beads on a 1/2-inch length of No. 20 wire.

2-METER SOLID-STATE AMPLIFIER

The circuit of Fig. 11-28 was developed for use with the new RCA 2N5995 and 2N5996 npn overlay rf power transistors. Low-inductance radial-type leads are used for the base, emitter, and collector connections. The mounting stud is independent from the transistor elements. This ideal feature makes it possible to bolt the transistor to the wall of the equipment case, thus using the cabinet or chassis as a heat sink.

Both transistors are "mismatch tested" by the manufacturer. This means that an infinite load mismatch from short to open can be tolerated by the transistors during driven periods, provided the maximum junction temperature is not exceeded. The circuit shown here was tested for both short and open conditions, and no damage to the transistor resulted.

Driving power for the 2N5995 is 3/4 watt. The 2N5996 requires approximately 5 watts drive to develop its rated power output. The 2N5995 can be used as a driver for the 2N5996 to obtain approximately 20 watts output at 146 MHz. Similar circuit constants can be used for both stages.

* NOW INCLUDES INSTRUCTIONS ON HOW TO CHANGE OUTPUT TRANSISTOR FOR 20-25 WATTS OUT!!

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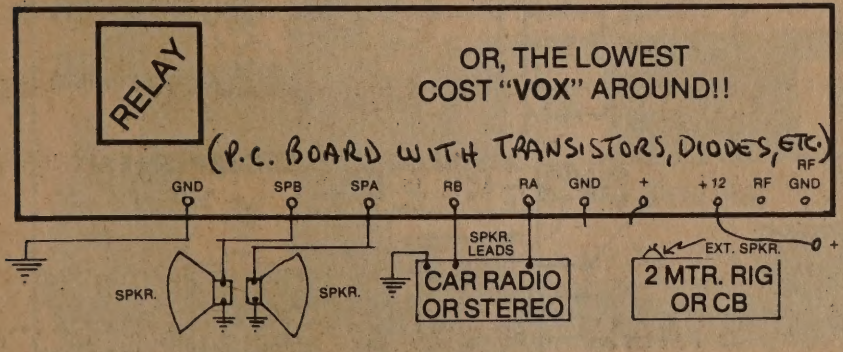

LESS THAN THE COST OF THE RELAY ALONE!

ORDER PART # REL-12

With this simple installation, your car speaker (or speakers) are connected to the radio — until the electronic circuit on the board senses audio from your rig. It then automatically switches the speaker to your rig. It holds it as long as there is audio, and then returns it to normal radio operation. If the "RF" & "RF GND" are coupled to your rig's antenna, it will mute the radio while transmitting — complete and automatically eliminating the need for switching one unit off and the other unit on!

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NEW SOLID STATE TV—IF STRIP!

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Motorola/Quasar (19TS-620) Brand new, fully guaranteed Printed Circuit Board. Contains Video IF chip, Sound IF/limiter/FM Det./AF preamp chip, plus 10 other transistor stages-all work when 20 volts (B+) is applied. Accepts input from VHF/UHF tuner & provides video, audio, sync and horiz. & vert. drive signals. Measures 5"x9"x1¾. Great for "off-air" receivers, decoders, etc. Supplied complete with schematic. Just what you have been looking for - a complete set of signals for all those new TV experiments you have been working on!

MONEY BACK GUARANTEE!

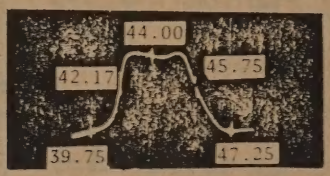

Fig. 2

I.F. BANDWIDTH

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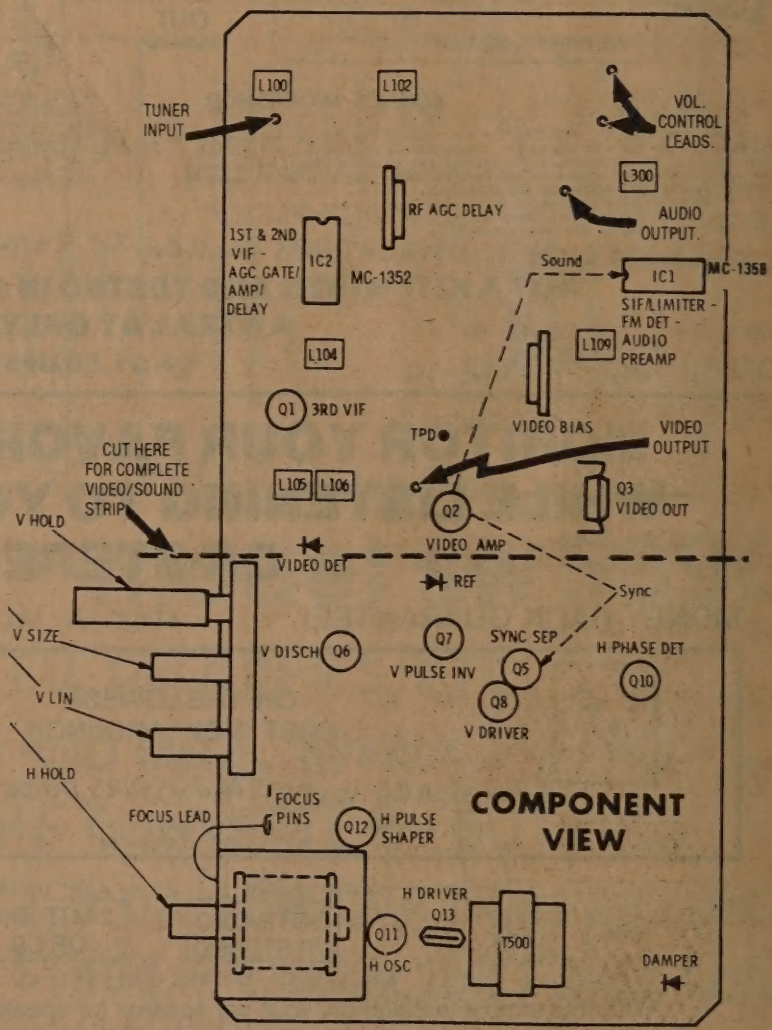

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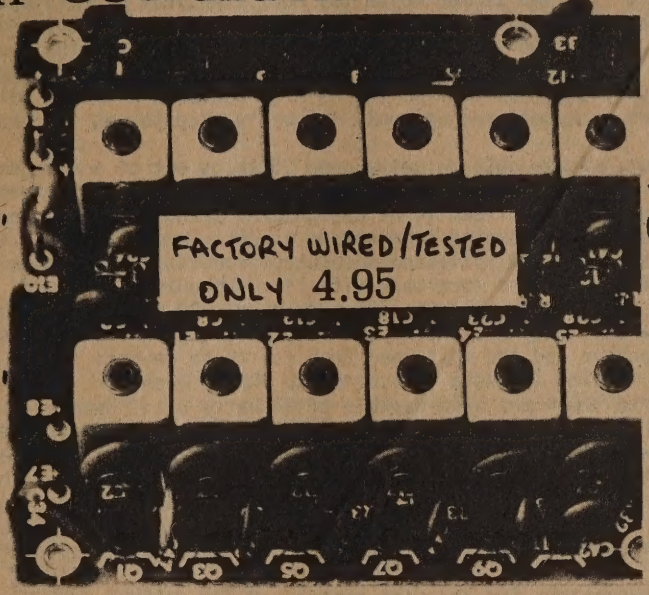

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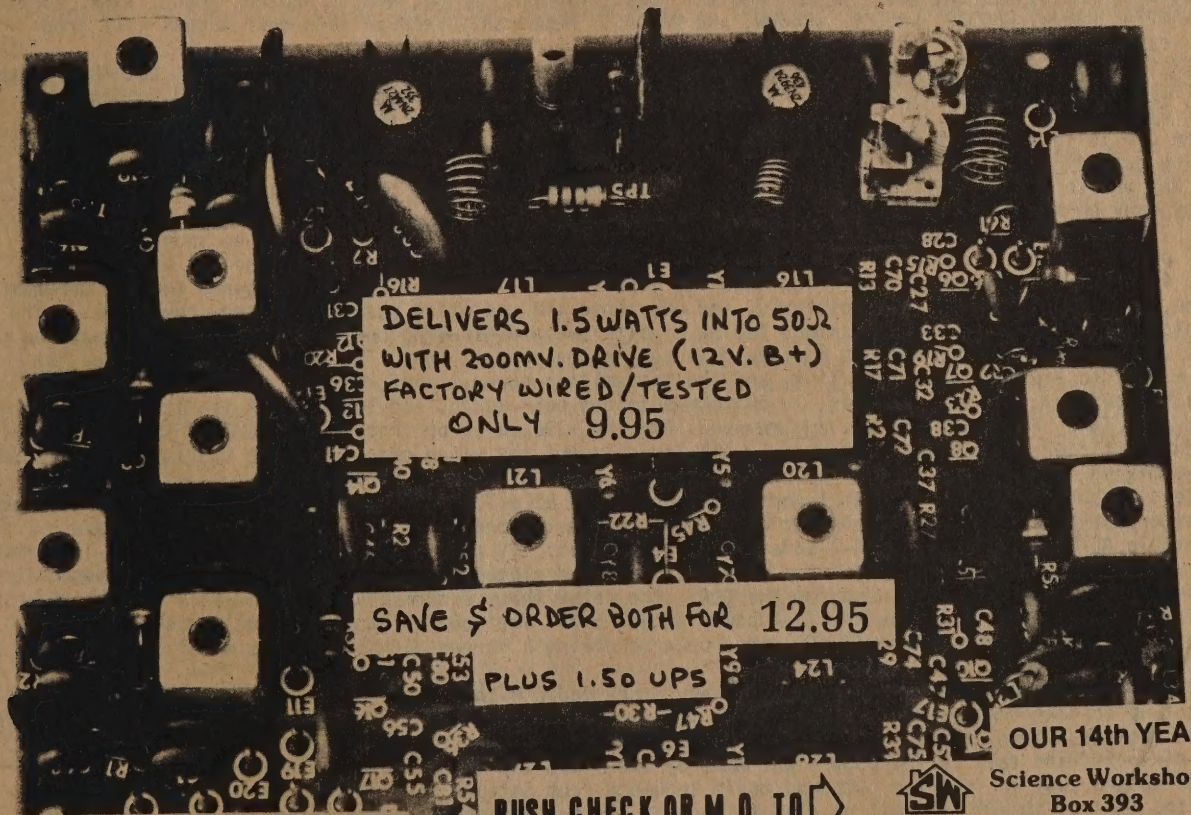

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ORGY REPEATER NOTES by Tom W6ORGy

YES, I know it's been a while since the last ORGy Repeater Notes, but I wanted to be able to report something positive on the increased power project. I did quite a bit of research on poweramps and their reliability for continuous service on mountain tops.

2C39 type amps: The remote base and repeater people told me that at 450 these tubes last about 6 months when run at half power dissipation (50 watts left in the bottle). You have to add to that fan motors wearing out, and the fact that HV power supplies go out more often than LV due to capacitor aging and shorts from spiders and bugs. The flat plate line amp seemed to be the most efficient and easiest to build and optimize. I borrowed and tested on that Sam K6VLM built from the Jones VHF Handbook (CQ pub) and it worked very well. It's about the same as the one in the RSGB VHS Manual, and I recommend it over the cavity types for those interested in building an amp. With 700v on the plate, a single tube flat line amp gave 22 watts out for 5 watts drive. The two tube cavity amp I built from the 72 ARRL Handbook with the help of Ralph WA6OFO only put out 15 watts for 5 drive, but once soldered up could not be tweeked to get the best out of it...especially the output coupling.

High power Varactor Tripler: I was able to get a good 25 watts out of a selected MHW-720-1 which could have driven a tripler to 12 to 15 watts out. This selected power module had surprisingly good lineraity, but the increase from 5 to 15 watts did not seem to be enough of a change to me to proceed in that direction. But I did use the module for the antenna mounted 1282 remote at JPL...more later.

1200 25 to 35 watt Transistor Amp: A collector modulated transistor amp seemed to me to be the best way to go. It could sit there for years and work well with little problem. I found, however, that few transistor manufacturers make parts for CW service workable at 1200 mHz or over 20 watts out. The actual dice input and output impedances are so low that they use one or two step matching inside the case. This means that they are useable over about an octave and the most used freq for these devices is 800 mHz or 2 gHz. The curves look lousy at 1200 to 1300 mHz. I came across a device in the TRW RF Designers Handbook, however. that is tuned for operation in the 1000 to 14000 mHz band capable of 35 watts out. However, I called R. V. Weatherford in Glendale, their distributor, and was floored when they told me the price was $282 each and 10 weeks delivery. I then put the word out to a few people who might be able to wrangle a freebie "engineering sample" hoping at least one would hit. Well, this morning, Bill WB6OFG called with the great news that he had been able to get one through Huges and that it would be in the mail...tnx Bill! So now the plan is to get a Teflon-glass PCB made and test out the amp. If it looks good we will design a collector modulator for it. If all goes well then I'll build a separate complete transmitter around it and put it up on the hill.

MEMBERSHIP: We now have 28 supporters for the site rental: K6SBV, WA6MDT, WA6SVT, WB6FXG, WA6ZMI, W6BLK, WA6OFO, W6YBI, WA6MVD, WB6PJA, KO6E, K6KDO, WA6YIE, K6MOZ, WB6OFG, WA6IGY, W6SFT, WB6ZPN, N6BCK, K7SF, WB6YIX, WA6MPI, WA6PFA, KB6OW, WB6BAP, WA6SGE, WB6CMW, and WA6CAS. Membership renewal then next August will drop to $9 at least.

VOYAGER 1. CLOSE ENCOUNTER WITH SATURN. Some members of the JPL Ham Club approached me at the ARRL Convention last September about adding fast scan to their slow scan operation commemorating the event and sending the video out directly as it came in. I went up about a month ago to tour the facilities and see how we could help. The Lab is located down in an arroyo above Devil's Gate Dam in Pasadena and is therefore a poor location for getting out any video on 434. But looking up 2 miles away is the QTH of Dale W6YFT up on the hill. So the best way out to enable everybody to see the pictures was to put it out thru a link at Dale's that could be seen by many on simplex as well as through both repeaters.

At JPL I installed my antenna mounted 5 watt 1282 mHz xmtr with a loop Yagi. It was so smoggy and hazy the day I put it up that I couldn't see Dale's house and had to guess. We placed the control box on top of the Robot 400 used for slow scane and "T"ed into its video input. They could switch between the JPL program video line, a camera setup for still pictures, and one above the operating position to show themselves. The video equipment was ancient with one camera having 2 volts out and blanking only. I had not planned on the different video levels and did not put a video gain pot on the control box. The control box contained the mic amp, a VA-2 to tap into the video line, and the transmitter power transformer. 3 cables then went up to the rain-proof box... 1v video coax, 1v 600 ohm shielded pair audio, and 18 VAC @ 3A isolated. The transmitter consisted of a TXA5, FMA5 with the mic amp removed, PA5, MMC1296 varactor tripler, and LM338K 13.8v regulator with bridge rectifier and 5000 mf filter cap. All lines except the video coax had to be isolated from ground to prevent mixing of the signals and ripple over the 50 foot length of the cables.

At Dale's we put up a MMC1296 crystal controlled converter at a loop yagi pointed down at JPL. I modified the converter for type N input and F output with 12V power up the center of the coax. The receiver was a Sears portable AC/DC TV set with a VM-2 added for video output. 1V of video was cabled over to a TC-1 transmitter converter. Audio was tapped off before the volume control and plugged into the VCR audio input of the TC-1. A TSQ-1 squelch/S meter board was used for the COR. The relay that is normally used to switch the speaker audio in and out was used to switch the TC-1 power on and off. The squelch knob was then adjusted to turn on the xmtr when the TV set's video IF AGC rises upon receiving a strong signal. Dale's 88 el J Beam was used to xmit the 434 video.

We all got to see the Voyager pictures before any other media with the direct feed. The following Monday when I went up to take the system down, they gave me a 3-hr. tour and allowed me to videotape anything I wished... full-scale mock-up, video studio, mission control, computer room where they add the color and enhance the incoming pictures, and talk to the people who make up the video tapes and movies. In a week or so I'll get to go back up and copy on tape the outbound movie sequence from Satturn and the best pictures. I'll make up an edited tape of it all and will be glad to dupe it off for anyone who wants a copy on 2 hr VHS. From this experience it seems that linking on 1200 (or other higher freq) may be just the thing for getting in and out of difficult areas or better coverage for public service events. JPL asked about linking out to Goldstone for Voyager 2 in 9 months. They have a site at Table Mountain that might hit it on 434.

10 GHZ GUNNPLEXERS: Advanced Receiver Research is coming out with the Microwave Associates Gunnplexer transceivers. So far, they are just running audio, but I am working with them to make a video version. We should have more info for those interested in a few months. We did find out that the results using AM video were lousy, so an IF and discriminator is being designed for quality video. Using the horns on each end should give at least 5 miles snow free. More with dishes which will be good for links & remotes.

VIDEO REVIEW: This is a good magazine for technical reviews of the latest cameras and video cassette recorders plus tips on taking good video pictures. The latest issue had a table of the latest VCRs listing all their features and cost. The technical reviews are done by an independent Lab, and they seem to tell it like it is. So if you are considering buying VCR or color camera you might want to see what they have to say and compare the specs and features. For instance, I found that the fast forward and reverse reviews in all but the new Magnavox only work in one or possibly 2 speeds. Most only work on 6-hr. mode and some 2 and 7 hr but not 4 hr. The magazine also reviews the latest tapes available. To subscribe it's $15/yr to Video Review, PO Box 191, Farmingdale, NY 11737.

1200 MHZ CAN-TENNA: One popular feed among the weak signal people is the coffee can. Actually, one person at the last VHF Converence used a fish pail and got 5 db gain, and when he put a fish in it, it only dropped 1 db! There is a good article in Ham Radio Magazine on how to figure the dimensions for optimum gain and dish or reflector illumination. If you don't have the May 76 (p.16) issue, and want to build one, send me a SASE and 25¢ and I'll make you a copy. It looks like a can with a 7" minimum diameter will work best. If you are in a strong signal area for the repeaters, you might get away without a reflector. The bigger the diameter the higher the gain. The height of the can should be twice the diameter or more. The position of the ¼ wave probe depends on the diameter of the can. A 7" dia. should give 5 dbd, a 10" dia. 11 dbd. Add to that the gain of a dish if you like...at 1200 a dipole feed 2' dish has 15½ db gain, a 4' is 21½ db, and a 6' is 25 db gain. Anything larger will just blow away@ Good info on dishes in the RSGB VHF-UHF Manual.

ORGANIZING AMATEUR COMMUNICATIONS FOR PUBLIC EVENTS is the name of a good article in the Dec. '80 QST that has a lot of good tips if you are interested in doing local parades or foot races. Check with sporting goods stores for marathons or 10K runs. How about setting up a mobile camera at the 1 mile point or other check point for those at the finish to see?

NEW 6 METER BAND PLAN ADOPTED IN SOUTHERN CALIFORNIA:
Simplex 52.525, 52.48, 52.54, 52.78, 52.80, 53.00 and 52.46 remotes 800 kHz splits in/out
52.02/.82, .04/.84, /06/.86, /08/.88, /10/.90, etc. to 52.24/53.04 300 kHz splits:
52.26/52.56 at 20 kHz spacing to 52.44/52.74. The Mt. Wilson WR6AAK public repeater will be 52.20 in/52.50 out
HAPPY CHANNEL 2 JAMMING!

There is a proposal to the FCC to allow some spread spectrum tests in the 450 band. I don't know if there will be any here.

CAPTURING 147.54 for ATV. The two meter band is really crowded with new hams fresh with a synthesized rig and without knowing the local band plan and gentlemen's agreements. Most people when politely informed will qsy or join in. It took a while to "capture" 146.43 from a few nets and ragchewers. It was done by patiently waiting for them to clear and then getting on and occupying the channel. Words to the effect that it's a coordinated ATV freq, or we've been here longer than you have only made others mad, just as it would ourselves. If they hear ATVers on the channel most of the time they turn on their rigs, they will give up and find another simplex freq. to carry on. So give 147.54 a try everytime you psy off 146.43 for a contact even though it may be occupied occasionally.

THE KING OF THE QUAGIES MEETS QUEEN DIANE:

SO CALIF. IS QUAGI LAND: Or so it seemed after the last ATV Club meeting with Wayne Overbeck, the King of the Quagis. If you missed it you really should have been there...lots of good info and discussion. Most of the info has been discussed about 432 quagis and is well known, but it was interesting to hear how it evolved from his dissatisfaction with the Cushcraft Yagi (sound familiar?). He did not have any measurements on bandwidth as he was only interested in 432 but will let us know when he does. The bandwidth at 2 meters is about 3 mHz, he said, and could be scaled to 432 to give about 8 to 9 mHz. If anybody has one and can measure the 3 db power drop points, we would like the info...maybe cutting the antenna for 432 instead of centering on 436 would give enough to cover the actual information video sidebands of interest between 426 and 438? Maybe bigger dia. directors? Wayne said that scaling to 1296 did not work as there must be some significant factor that doesn't pop up at lower freq. Anybody for finding the magic fudge factor?

Antenna measuring set-up was particularly interesting. Wayne said that placing the source antenna 1 wavelength above ground and having the receiving antenna 40 wavelengths away in the clear gave reliable results by getting away from ground reflections. The TVG-12 could be used as the source 8" off the ground and 31 feet away in the yard for playing with 1200 antennas. But a pickup dipole on the 1200 converter for reference and then exchange it with the antenna under test. A step attenuator between the TV and converter can be adjusted to then read out the difference (gain) by setting to the same TV video IF AGC voltage. A sig gen could also be used as the source and just read off the variable attenuator. Wayne said to move the antenna around a little to see if there were any significant reflections that move the reading more than a db or so as the position changes about a wave length. With reflections or closer distances to the source, he said low gain antennas look better than actual and high gain antennas look worse.

Tom W6ORGy

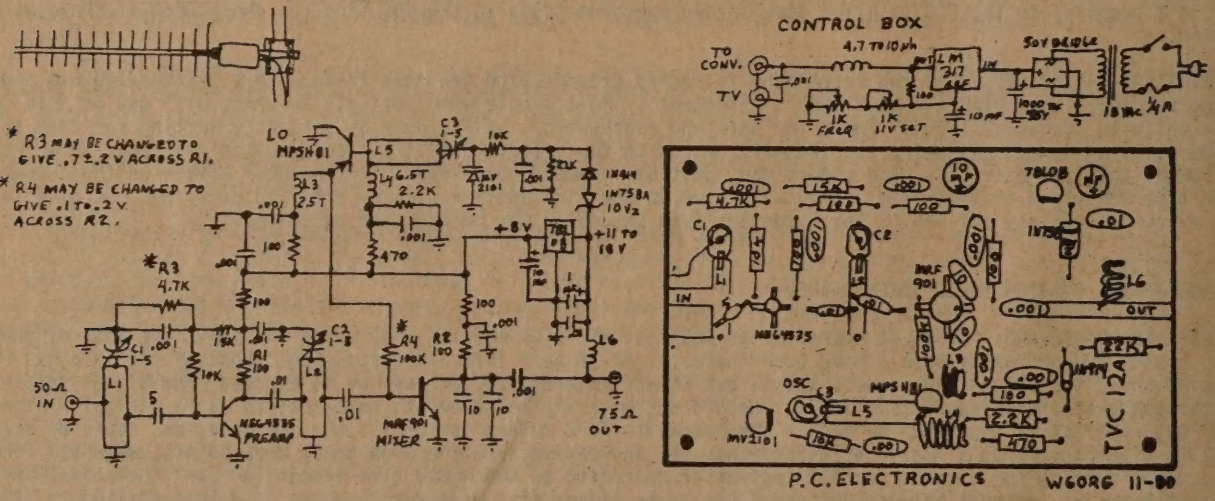
TVC-12a 1215-1300 MHZ DOWNCONVERTER

This ATV downconverter is designed to be mounted at the antenna to receive signals without the normal feed line loss. The output is on TV channel 7 or 8 which will have 7 times less loss in coax than if the converter were placed in the shack. A control box will have to be made for power and varicap tuning as the dc is run up the coax.

If you are using the 1296-LY loop yagi, carefully bend the rigid coax over a screwdriver handle (1" dia) and attach the converter to the N connector. Connect the output coax (RG6 with F connectors...Radio Shack 15-1527) then spray the antenna and converter with a few coats of clear Epoxy for weatherproofing. When dry, tape the case seam and 4 screw heads and connectors. Spray another coat. The converter can be held to the antenna boom with large cable ties and tape. Attach the antenna to the mast by either inserting a 5/8" dia wood dowel for strength down the boom and drilling two ¼" holes for the U clamp (15-826) beginning 3" from the end, or making up a mounting plate with two U clamps for the mast and two 1" ID clamps for the boom. The latter is more adjustable and stronger.

CONTROL BOX: This must be a metal box to prevent strong adjacent TV channel pickup. All parts are available from Radio Shack. You might want to get a large enough cabinet to add a TSQ-1 S-meter/Squelch board as the meter can be switched and calibrated in freq. for tuning. Use a DPDT switch with the meter leads and connect one side to ground and the other thru a 220K resister to the top of the 1K panel freq. tuning pot. Initially set the freq. pot to zero ohms. Then set the 1K trim pot to give 11 VDC output (this is the lowest freq. point). Mount the two F connectors close to each other and keep the RFC at the connector with short leads. Use coax to the TV. If there is strong adjacent TV interference, cut off the twin lead at the VHF Tuner and attach a 75/300 ohm balun (RS15-1140) in its place with the twin lead cut as short as possible. Tape the F connector side if the set has a hot chassis to one side of the AC line.

For duplex or repeater operation with a 434 mHz transmitter, the vertical separation between antennas must be at least 5' for 10W out. You will probably see your own 3rd harmonic at 1302 mHz. Carefully turn the converter and rotate the antenna for your station. The Loop yagi has a high 18 dbd gain and therefore a sharp 10 degree beamwidth. 1200 mHz has much more foliage absorption than 400 mHz, so the antenna must be above the tree line for best results...at least 45'.



WATTS BUZZ'N COUZZIN

One long-time problem with the FMA5 audio subcarrier board has been RF rectification in the first mic amp. The 4558 IC will detect the video modulation from the stray RF field given off by the TXA5 exciter unless the board is completely shielded. You can ove wires and parts around on a case by case basis to make the RF field null in the area of the 4558; but as soon as you put a cover on or add another module to your system the game starts over.

Bifet op amps are now on the market that have a JFET input and bipolar output. They are wider bandwidth and much higher input impedance. But for our problem of RF rectification the Gate / source characteristcs are such that it can handle much higher RF signals before trying to become a detector. The 4558 is a bipolar input with a sharp base / emitter knee that loves to become an RF detector. So far, we have tried swapping the op amps in 5 modules with a big reduction in the amount of sync buzz in the audio from RF pickup.

So if you still have too much sync buzz in the audio and cannot physically shield the whole module effectively, try replacing the 4558 op amp with one of the dual bifets. Some of the types that are directly interchangeable are: TL082CP and the LF353N. The LF353N is available from Radio Shack and their part number is 276-1715.

Sound it out for yourself! ..... DE W6ORG

TIME MULTIPLEXED SPEECH AND SSTV

Clarence J. Munsey K6IV

Introduction: It is assumed that human speech contains redundant parts which may be removed with little effect on the usefulness of speech. One means of removing assumed redundant parts is to tape record the speech, cut pieces out of the tape every few inches and splice the remainder. It is reported ("Playback Control Speeds or Slows Taped Speech Without Distortion," Electronics, Auug. 22, 1974) that such an experiment results in acceptable speech quality when played back. Note that in this experiment the speech is speeded up, but unchanged in pitch.

In the experiment just described, some portion, say half of the speech train is discarded. Extending this idea to voice communication allows speech to be transmitted half of the time and something else the other half.

In our case that something else is SSTV. In principle, speech and a SSTV line are transmitted alternately. This requires 16 seconds for one picture instead of the standard 8 seconds. In this scheme speech arrives at the receiver for the duration of one SSTV line (66 milliseconds), then is silent while an SSTV line is transmitted. Such a pattern of 66 milliseconds of speech followed by an equal length of silence produces a useless result. The silent period must somehow be filled in. To fill in silent periods in these experiments, the segment of speech just received is used. In other words, the listener hears an original segment of speech as it arrives and then hears the same speech over again before hearing the next original segment.

An experiment with 66 milliseconds of speech and 66 milliseconds of repeat produced poor results and it was found that shorter active and repeat segments were better. 33 millisecond alternations produced good results. For convenience, we wish to alternate entire SSTV lines with speech. Figure 1 shows how this may be accomplished even though the speech segments are only 33 milliseconds long. (A) represents segments taken from a continuous signal using equal active and silent periods. (B) represents these segments after they are concatenated and synchronously added to a half-time SSTV signal. (C) is the SSTV signal recovered at the receiver. Note that present SSTV scan converters must be modified to work properly with this signal.

(D) is the received speech signal spread out and filled in by repeating the previous segment.

EXPERIMENTAL METHOD: An experiment was conducted to determine the quality of half-time speech. The experiment apparatus consists of a Heathkit H-8 digital computer with a built-for-the-purpose analog-to-digital converter and a digital-to-analog converter. These converters have low-pass filters associated with them. Figure 2 is a block diagram of the auxiliary board. This interface was constructed on a Heathkit proto board which plugs into the computer bus. The analog-to-digital converter is a Burr Brown ADC 82 that samples at a 500 KHz rate. Data is taken from the converter at an 8 KHz rate. The input filter limits the bandwidth to 2.5 KHz. Due to the high sampling rate of the converter relative to the input frequency, no sample and hold is needed.

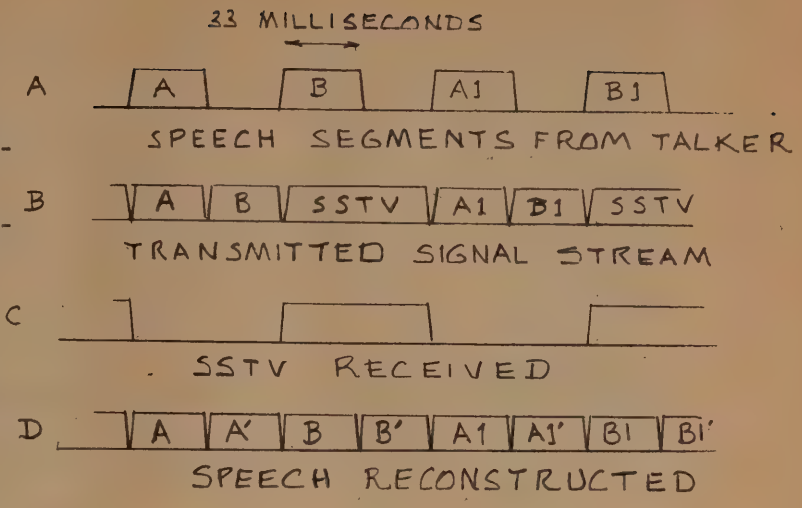


FIGURE 1 - TIME SERIES OF EVENTS

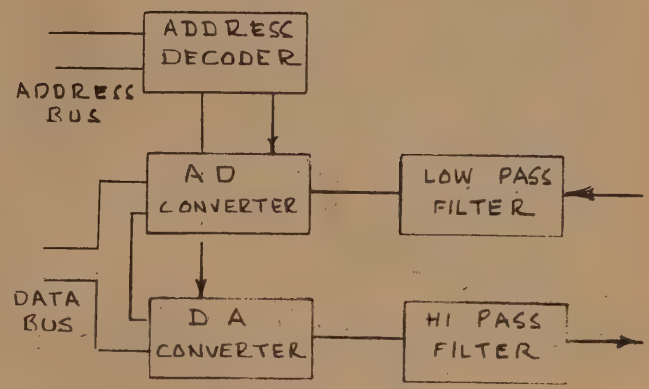


FIGURE 2 - INTERFACE CARD BLOCK DIAGRAM

The conversion subsystem is 8 bits wide and operates at an 8 KHz sampling rate. These numbers are taken from telephone practice. An 8 bit wide sample of speech is barely enough to avoid undesirable quantizing noise. In telephone practice non-linear coders and decoders are used to reduce quantizing noise.

A computer enables a large number of different experimental configurations to be tried. A flow chart of the program used to make the demonstration tape is shown in Figure 3.

Following down the flow chart, virst various computer dependent constants are established before entering the main program. A sample (one 8 bit sample from the A/D converter) is brought into the computer. This sample is put out to the D/A converter to make its contribution to the output speech train. The same sample is stored in a tabular memory so it can be used again. A control counter, which is used to fix the total number of samples and thus the time of a speech segment, is incremented and tested. This process is repeated until the desired number of speech

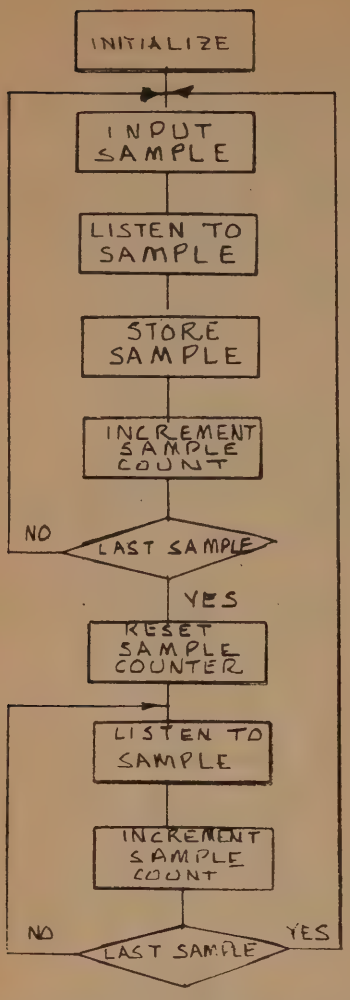


FIGURE 3 - COMPUTER FLOW CHART

samples are taken. The next part of the program is used to repeat exactly the same speech pattern on the output by stepping through the tabular memory again. When this is complete the process starts over again. The time duration of the active and repeat segments is controlled by the number of samples included in the table.

Two refinements not shown in the flow chart are important. First, all samples must be taken and played back at exactly the same sampling rate to avoid changing the pitch of different parts of the output speech train. Sampling uniformity is created by inserting software timing delays such that a sample rate of 8 KHz results. The second refinement is that the segment amplitude must start and stop gradually to avoid disturbing clicks at each changeover from an original to repeat segment. Tapering the leading and trailing edge of the segment calls for multiplication routines that are normally too slow for the 8 KHz sampling rate. This problem calls for using programming tricks to multiply within the time limits.

DISCUSSION: A tape recording of speech processed by 33 millisecond active and inactive segments illustrates that this method of half-time voice transmission results in understandable speech. There is distortion present which prevents natural sound.

An input-output hardware board and computer such as used in this experiment are excellent tools for other ham related experiments. For example, perhaps impulse noise can be removed from the radio receiver output. Another example is a digital speech compressor.

MT. WILSON REPEATER NEWS: Seven days a wekk operation is now in progress. The Control System is in place and working. I have installed a User Control System and here are the Functions: Repeater operation #5; AUX video in (the Repeater transmitter is also keyed); *5 transmitted subcarrier on *6, subcarrier off #6. 146.43 high volume #4, and low, *4. Functions 1,2,3, are wired to a connector strip for future added gear such as a beam antenna, linking to other Repeaters, etc. Digits 7 and 8 are set aside for the W6ORG Repeater for a fist access digits, * and # are the first access digits for Mt. Wilson. Digits 9 and 10 are in reserve for future functions. To access a Function, depress the * or # button followed by the function digit in that order only. The * and # hold circuit will only hold for 2 seconds, so if you goof, simply re-access. The Repeater will be used for the Rose Parade this year, so please use 426.25 as an alternate ATV channel as well as 146.43 FM on the afternoon of Dec/31/80 and Jan/1/81. The repeater will be free in the late afternoon of Jan/1. 147.54 is the alternate calling channel for 426.25.
-- Mike, WA6SVT

INLAND EMPIRE NEWS: Bob Raidy passed away on 12/9/80 from a heart attack. He was known as the "Rabbi" before he retired from the Pacific Telephone Office in San Berdo last year. Jack, WB6CGN, is up now on 434, using 2 15 element Quagis. Sigs improved a P unit here. Ken, WB6MQQ, is now running 30 watts out of a CMU-15 with blower and his sigs are now P-3 here. Receiving 1265 sigs, P-1 now here, hope to see it better when the amp goes in the Repeater.
-- John, K6KDO

WEST SIDE NEWS: K6OE was seen on 434. W6SFI has new ORG down converter, and antenna for 1200, but not receiving the Mt. Wilson machine yet. K6HCZ is putting out a signal on 1200 with an APX6. WA6BHF heard on 2-meters after being ill. K6KCX, a non-member from Marina Del Rey attended the last ATV meet at the QTH of WB6OFG. W6RVP is transmitting on 1200, using a GR generator, and pin diode mixer, can work Alex, K6HCZ, next door. WB6ZPN, Johnny has his 1200 down converter, and antenna, so will be receiving soon.
--W6RVP, John

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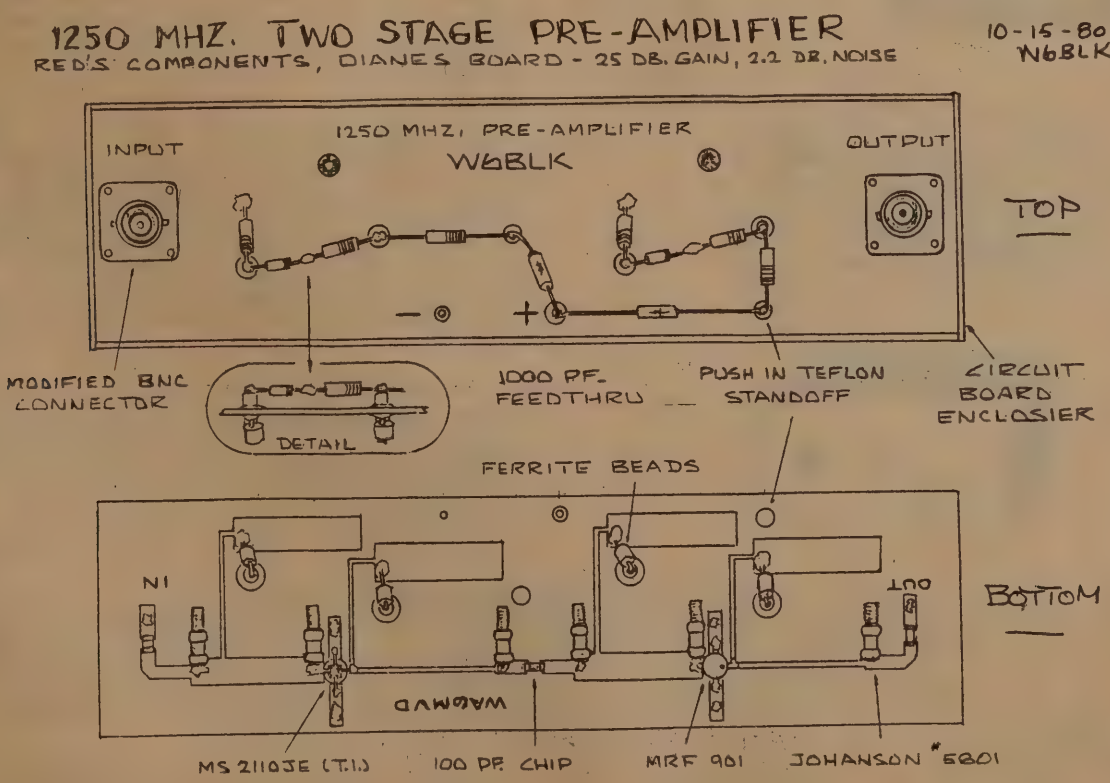
FROM: SCATVC

.6 db NF for $5.00: THE ULTIMATE 432-mHz Pre-Amp:

Now probably not everyone wants to run out and build a pre-amp like this, but you might just want to see what a $5.00 device can do these days, or you may want to sharpen up your building technique for the lower frequencies. In any case, if you decide to build one, you will have about 20 db of gain and a .6 db noise figure. No matter what you spend on a device, you can't get better specs. The 3SK97 is available from Lunar Electronics for $5.00. It is a dual gate MESFET (metal semiconductor field effect transistor), with unprotected gates. A MESFET is actually a type of GASFET. Because the gates are unprotected, great care must be taken in handling so that no statis electricity discharges through the gates. This doesn't mean that you will probably wreck the device, it just means that you must be careful. The schematic and parts layout of the pre-amp follow this article. As you can tell, the input and output are tuned, which helps to filter out any 2-meter interference if you are using Oscar. Unlike Microwave GASFETS, these are not finicky to adjust, and the gain will not run away on you. It is a pretty tame beast. Notice from the layout how the source and gate 2 are mounted. The .001 bypasses must be Chip type Capacitors. A regular capacitor would have enough lead inductance to form a tuned circuit somewhere in the pre-amps range and make it oscillate. The tuning capacitors are miniature Johannson types. They are a special piston type, but they are not expensive. If you use ceramic trimmers, their losses could ruin what you would gain by using the MESFET. I have a bunch of the Johannsons, and I will make them available to any serious builders. While you can use BNC connectors with good results, you may want to use SMA types. They are less expensive, mount easier, and lower in loss. Also, you won't have to burn up the pre-amp to solder them into the case! I would like to say something about what you might gain in your receiving system by using one of these. If you currently have a converter with a 3 db noise figure, and an antenna with 14 db gain, you might expect the following: For each db of decrease in noise figure, expect a 10 db increase in sensitivity. Conversely, for each db of increase of loss, expect a 1 db increase in noise figure. That should give you about 20 to 25 db of increase in sensitivity above the gain of the antenna. This should be like switching to a 20 ft. dish. Not bad for $5.00. This pre-amp should make converters like the "Hamtronics" and the "Microwave" modules into ultimate machines for 432-mHz. The circuit is also broad enough to cover most of the 430 to 450 mHz band with one tuning.

73, K6JEY, Doug Miller



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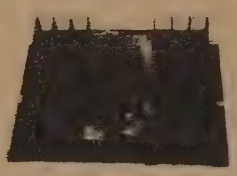
CA-1 video carrier audio/18 mhz osc add $49



2. PA5 10 WATT ATV POWER MODULE ..... **$79 ppd**

The PA5 will put out 10 watts RMS power on the sync tips when driven with 80 mw by the TXA5 exciter. 50 ohms in and out, plus bandwidth for the whole band with good linearity for color and sound. Requires 13.8 vdc regulated @ 3 amps. MHW-710 . . . $50 ppd

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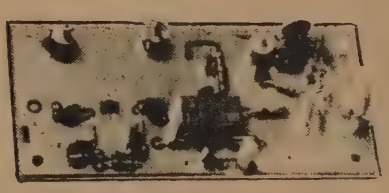

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MARYANN WB6YSS
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A5 Tech Expert Tom O'Hara Looks at the Preamp

THE ULTIMATE PREAMP! The actual .5 db NF device that is talked about is the Dexcel GASFET which costs $25. They are selling this preamp for $125 and have actually measured some down to .2 db nf. They also do sell a dual gate GASFET, the 3SK97 for $5...you can also get it if they ever come in from Panasonic for $1.50. But it is rated at 1.7 to 2.8 db noise figure and 11 to 20 db gain at 1gHz.

The MRF901 is slightly better in specs, and the NE64535 outdoes them both. If you get the Dexcel GASFET you also get the app note to build the preamp.

The statements on what noise figure and gain dbs mean are misapplied. If you add a lower noise preamp to a receiver that has insufficient gain, then you will improve your sensitivity by the difference in noise figure plus the difference between the sensitivity of the receiver and the point to where it would just amplify noise. This is true of many two-meter rigs that are maybe 5 db shy of optimum gain. But if you have a receiver with just enough gain to amplify the first stage generated noise or cosmic noise, then adding a preamp will gain you maybe the difference in noise figure or nothing.

WHAT'S IT ALL MEAN TO YOU? There is a limit to the sensitivity of your receiving system. For ATV on 434, it's about seeing sync bars at .2 microvolts at the preamps input. Adding more preamps or ones with noise figures of less than .7 db won't improve it. The cosmic noise level at 434 is about the equivalent of .8 db noise figure so a preamp of less noise figure won't change the picture much. More gain will just saturate the detector and change the looks of the snow on the screen, but the ability of seeing the bars in the picture won't change for the better, but will be worse as more gain is added due to limiting and intermod.

So how much gain do you need? Depends on the TV you use. I've found that most TV sets video IF ACGs come into action about 5 to 10 microvolts. If your converter and/or preamp is pumping up the AGC now (take a reading with it off and see if it moves when the converter and preamp is turned on), then you have too much gain and are just amplifying noise. The picture may appear darker, but this is due to limiting. You also run the risk of more two meter interference, radar, and other strong signals messing up the video. For most sets a converter and rf preamp with a low noise transistor around 1 db and a total gain of 20 db is about optimum. This keeps the noise floor about 6 db below limiting but lets you see the sync bars down in the noise at .2 to .3 microvolts. If you have a set that has low gain, peak up the vhf tuner at channel 3 and 8, or add a channel 3 or 8 preamp between the converter and TV. Adding the gain at this point will help the out of channel rejection, less intermod, etc. due to its selectivity than a preamp with typically 30 mHz band width.

OK so I've done all that, but I still want more. What do I do? Put more signal to the preamp input! Do this by putting up the highest gain antenna you practically can and as high as possible. Coax loss is the next biggest factor. If your 100 ft. of Belden 8214 is losing you 3.8 db in xmit it's also losing it in receive and costing you 3.8 db in sensitivity. 7/8" heliax is expensive and hard to rotate plus gives maybe only a 2 db improvement when you are done due to having to put 8214 or 213 around the rotator and coax connector losses. So why not get it all... 3.8 db which leads me to the next article:

ANTENNA MOUNTED ATV CONVERTER

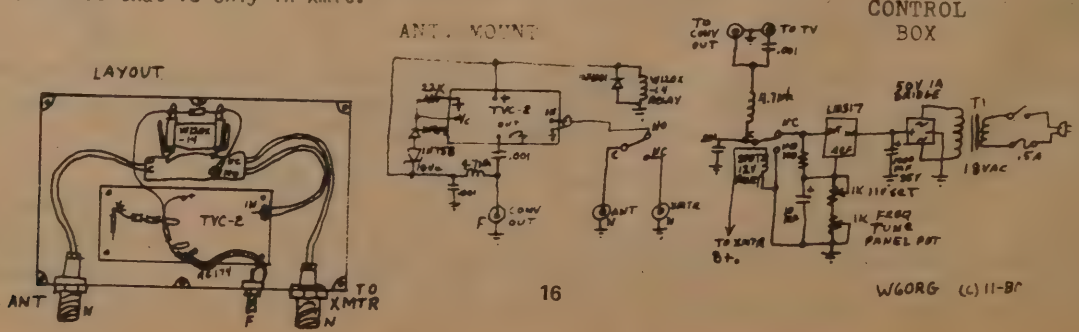
Antenna mounting the converter will give you an increase in sensitivity equal to the loss of the coax run to the converter in the shack now. If you have a 100 ft. run of Belden 8214 now, it will give you 3.8 db more. Since the noise figure is determined by the first rf stage and followed with sufficient gain, the coax loss at channel 3 is relatively insignificant. In fact, since the frequency is much lower, and therefore less loss in the coax, you can run 100 feet of Radio Shack Foam RG6 for only 2 db loss in gain but hardly anything in signal to noise ratio. (Radio Shack 100' with F connectors...RS 15-1527 is $13.99.)

The converter and coaxial t/r relay are mounted in a rainproof die cast aluminum 4x7x2" box. These are made by Bud (CU-246) and Hammond (1590D). An F connector (RS 278-212) for the converter output and DC control input, and bulkhead type N to RG58 UG 556B/U connectors for antenna and transmit. The N connectors have weatherproofing seals but the F connector and screw holes could leak. So I used a little 5-minute Epoxy over the six screw heads and around the nuts used to mount the converter and Magnacraft W120X-14 coax relay, also the F connector. The box is held in place on the antenna mast with large cable ties and tape. The connectors should be pointing down. Tape the cover seam and screw heads well and the connectors. Then give everything a few coats of clear epoxy spray...no Krylon or acrylics.

Electrically, the receiver is operating when 11 to 18 vdc is passed up the converter output line. This voltage will energize the t/r relay and tune the converter across the band. In xmit the relay is not energized which is a good failsafe against xmitting into the converter and blowing it, as well as saving a control cable. The 1N758A 10-volt zener drops the input voltage down to the normal varicap tuning range of 0 to 8 volts. The 1N914 diode in series with the zener helps temperature compensate the varicap. A 4.7 uH RFC isolates the IF from the DC and the .001s block the DC.

A control box must be built to operate the converter system. Most of the parts can be bought through Radio Shack. The LM317 is an adjustable voltage regulator that must first be set for a minimum output voltage of 11 volts with a PC type trim pot. Do this by setting the panel pot used for converter tuning at zero ohms. You can get fancy by adding a smaller pot for fine tuning or a 50K trimmer across the panel pot to limit the range. Or maybe a meter with freq calibration...a 10V full scale across the panel pot.

The SPDT 12v relay in the control box will ground the converter power in transmit. Connect one side of the winding to the xmtr + 13.8 FDC that is only in xmit.



W6ORG (c) 11-8

FABRICATION OF PRINTED CIRCUIT BOARDS

by

J. P. Salvin

FABRICATION OF PRINTED CIRCUIT BOARDS

J. P. Slavin

The amateur radio operator, hobbyist, or electronics buff, when he needs to lay out a prototype or test circuit, has two options open to him. He may decide to use "ready made" printed circuit cards, or out of necessity, he may be forced into a situation where he needs to build his own boards.

Pre-routed boards - that is, "ready-builts" - come in several sizes, types, thicknesses, and base materials. They already have conductor patterns etched on them and also have solder coated edge tabs. The boards are available in either epoxy-glass or paper based phenolic, one or two ounce copper clad, on one or both sides of the laminate. Typical board configurations are shown below. They include integrated circuit cards, universal circuit cards, D.I.P. Insertion cards, and extender cards.

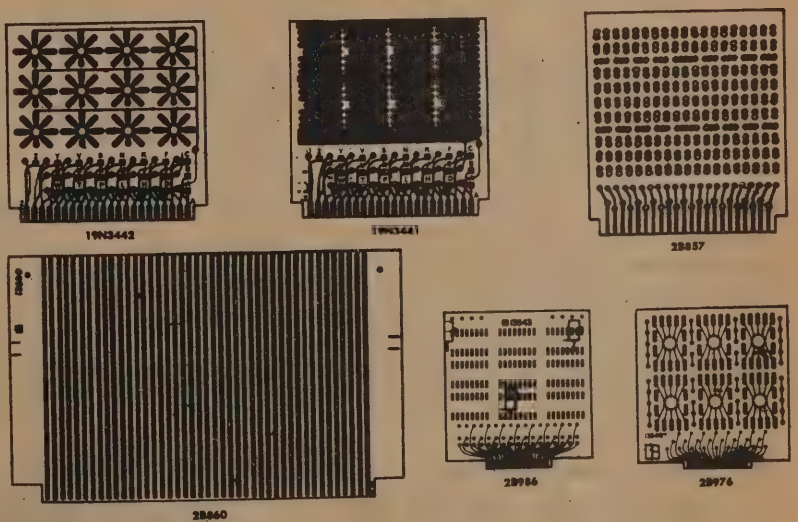


FIGURE 1 - Various Configurations of Ready-Built Boards

Another type of "ready made" circuit board which is useful in laying out prototype circuitry is found in the VECTORBORD system. It incorporates the use of pre-punched epoxy-fiberglass or phenolic laminate and a variety of push-in terminals to effect electrical interconnections. VECTOR plugboards are also available in a wide range of functional configurations. Some of these are: IC and Discrete mounting, universal D.I.P., wire wrap, and matrix types. Sizes of the pre-punched holes in the laminates are .025 and .024 dia. in the standard matrix series.

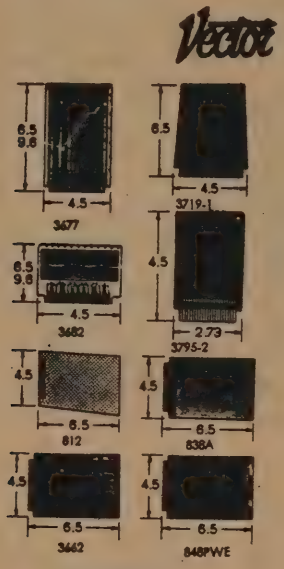


FIGURE 2

Types of Vectorbords Available

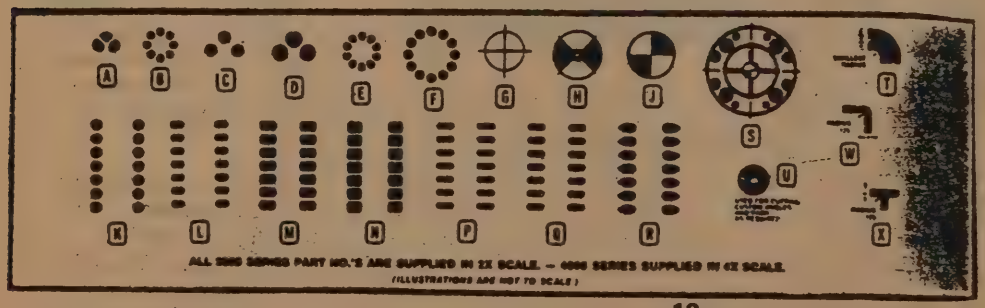
The last type of "ready made"" circuit board involves a bit more work than those previously mentioned. This type uses adhesive backed copper foil patterns and shapes to construct the individual conductor patterns or tracks. This system is marketed by CIRCUIT STIK and can be used on regular un-clad epoxy-fiberglass or paper-based phenolic laminates. In use, the desired patterns are transferred from the carrier sheet onto the laminate, then pressed firmly in place. Once the conductor pattern is complete, the mounting holes drilled, then the components may be mounted on the board and soldered in place. Examples of the CIRCUIT STIK patterns are shown below.

For the more adventurous hobbyist, who either wants or needs to build his own printed wiring boards, there are processes and kits available to him. The kits contain chemicals, materials, and instructions necessary to produce finished, rather professional looking circuitry. Several of these kits will be discussed.

The "standard-etched-circuit kit" containes three 3"x6" perforated sheets of single sided, copper clad laminate. It can be ordered with either epoxy-fiberglass or paper-base phenolic as the dielectric material. Circuit patterns are formed or designed on the copper foil by using either pre-cut pressure sensitive acid resistant tape or by drawing the pattern on the copper foil with a (water) resist pen. A third method of producing the desired pattern is by painting on a liquid resist coating over the copper. The copper conductor pattern is etched in the copper foil by using ferric chloride etchant supplied with the kit. This type of kit costs about $6.

The "professional-etched circuit kit" contains three sheets of sensitized (resisted) copper clad laminate. The resist coating is a negative acting type, although clad material coated with positive resists is also available. The sizes of the laminates are: one 3"x3" and two 3"x6". Everything is included in this kit to allow you to fabricate the positive artwork, using pressure sensitive drafting aids. Materials and chemicals in the kit are then used to produce the negative image artwork. Exposure of the sensitized copper clad stock, and its subsequent development, readies us for the final step in the board fabrication process. At this stage, the conductor pattern we are after is protected by a thin film of photoresist. The excess copper foil can now be removed. This is done by chemically stripping it from the laminate by using ferric chloride etchant supplied with the kit. The thin layer of photoresist may now be removed either mechanically or chemically. This type of kit sells for about $10.

The "silk-screen-printing kit: holds yet another method for producing do-it-yourself circuitry. This kit depends upon the user's capability to produce positive artwork on either acetate or mylar film backing, using the standard drafting aids and symbols. This kit supplies a printing frame with stretched silk cloth, sufficient film emulsion to produce chemicals and solutions to expose and develop silk screen images.



HAVE YOU HUGGED YOUR A5 TODAY?

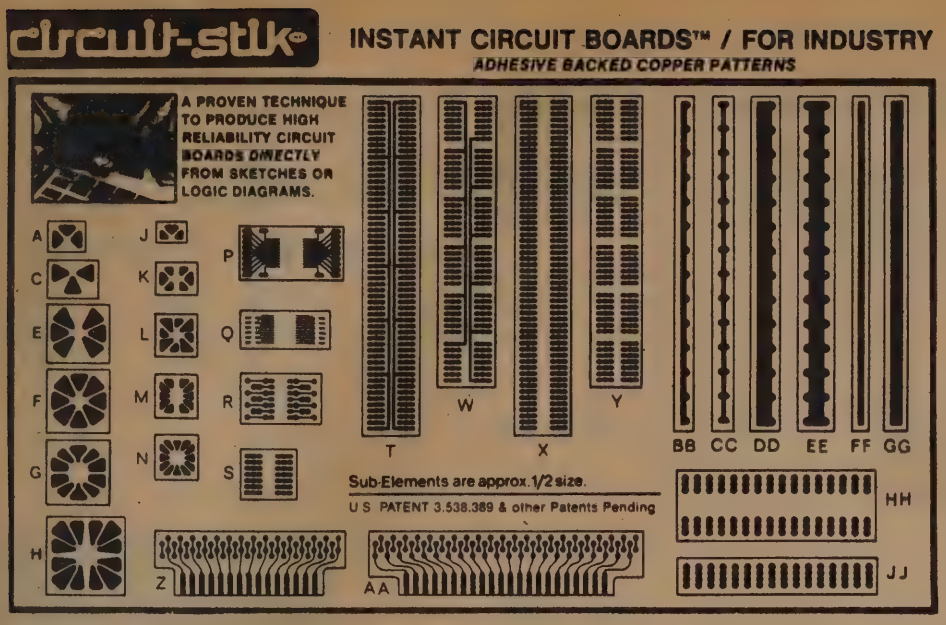


FIGURE 3a

Also included in this kit are a squeegee, mounting hinges, and a supply of acid resistant printing ink. The one thing this kit does not supply is the copper clad laminate. It has to be ordered separately. This type of kit sells for $40.

The "immersion-tin-plating" kit provides the chemicals necessary to mix a solution which will deposit a thin film (about 50 microinches) of tin over surfaces of chemically cleaned copper. The resultant solution is actually a 10% tin chloride solution. It must be heated to 150°F. Immersion times in the solution are about 15 minutes. The kit supplies a heat resistant tray, thermometer, and plastic tongs. The immersion tin coating preserves the boards' solderability and precludes the formation of copper corrosion products. This type of kit costs about $20.

Kepro Circuit Systems, Inc. handles a full line of bench type circuit board fabrication equipment. Their ad is shown below.

If the home printed wiring board fabricator were inclined to purchase any of this equipment, I would recommend the small shear and the exposure frame. The other equipment can be readily circumvented by things which you already have in your home.

In fact, the exposure frame could easily be duplicated at home with a little ingenuity and a trip to the hardware store's electrical department. Other than a wooden box to house the system, the exposure frame requires: several G-E F20BL ultraviolet fluorescent lamps (these are not standard fluorescent lamps), fluorescent lamp holders, a starter ballast, 0 to 5 minute timer, on/off switch, and a cover glass to act as the exposing surface. This would cost considerably less than $255.

LOVE IS AN A-5
SUBSCRIPTION

Another alternative for an exposure source is an enclosure containing either a photo-flood or sun lamp. Exposure times in the range of 5 to 10 minutes at distances of approximately 12 to 15 inches should be used.

All through the first part of this presentation, when I covered the various methods available to the home circuit board maker, one thing became evident. If you do purchase the various kits, a substantial investment is made, but the fruits gleaned from them are rather meager. In the last part of this presentation, I would like to give you several hints which will let you use the processes covered earlier, but save yourselves some money in the process.

Before we get to that, however, I would like to touch upon a diagram that shows what happens when we fabricate an etched copper circuit using a negative and positive acting resist, in conjunction with a negative and positive image artwork (see figure 5).

Briefly explained, when a negative acting resist is exposed using a negative image artwork, the clear portion - namely, the conductor pattern - hardens or cures. Upon development of this image, the uncured resist washes away leaving bare copper foil to be removed in the chemical stripping operation.

Quite a bit different is the condition with the positive resist system. Exposure of a positive acting resist, using a positive image artwork, results in the clear portion being washed away during the development step. As in the above case, now the excess copper can be removed by chemical stripping.

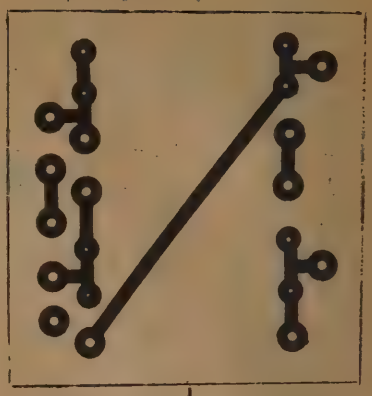
Now to get back to some of the hints which may help in your efforts to fabricate boards. If you will take a look at figure 6, you will see that LSi, in our Prototype Printed Circuit facility, has a system to build "quickie" boards. This same system is very adaptable to your situation.

FIGURE 5 -

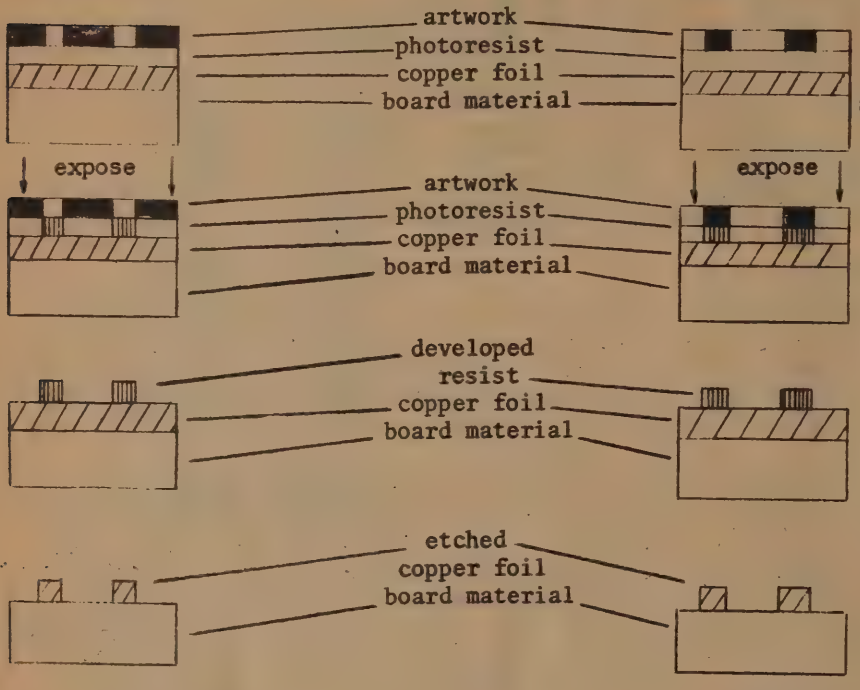
Comparison Using Negative and Positive Image Artwork in Conjunction with Negative and Positive Resists

negative image artwork

positive image artwork



a-positive artwork



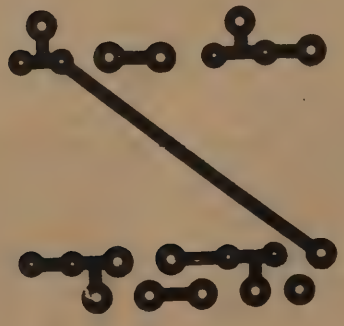
Using negative acting resist

Using positive acting resist

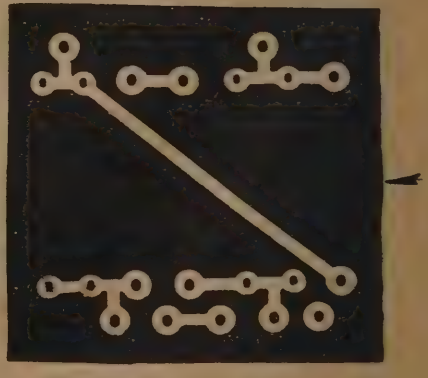
b-exposure film

c-negative image artwork

d-resisted copper clad laminate



e- exposed and developed image - dyed black



f- etched circuit board

We are usually supplied "original" positive artwork (Step A) made by using the drafting-aid-type stick-ons. It is laid up on a piece of mylar or acetate film. To produce the negative image artwork, we use two 3-M Co. photosensitive products. These are #8007 Schotchcal Exposure Film and #8500 Schotchcal Developer.

The positive artwork is placed over the exposure film (with the exposure film, emulsion side down) and a one minute contact exposure using an ultraviolet light source is made (Step B). The negative image artwork is developed by wiping the exposure film emulsion with Scotchcal developer until an image appears (Step C).

The negative image artwork is now used to expose the desired image onto a resisted copper clad panel (coated with Kodak KPR 3). A 1½ minute contact exposure of the resisted panel through the negative artwork results in the developed image shown in Step #. The exposed and developed KPR 3 image has been dyed black to make it more visible. Development of the KPR 3 image may be accomplished in Kodak's KPR Developer, or in trichloroethylene solvent. Either way, development time runs about three minutes. After development, the panel is water rinsed and dried.

Since the circuit we want is now protected by a film of KPR 3, we are ready to strip the excess copper foil from the laminate. The safest copper etchant which can be used at home is ferric chloride. It can be used in heat resistant glass trays and be heated to about 130°F, if the etch rate is to be accelerated. Ferric chloride has the ability to dissolve approximately 8 ounces of copper per gallon of solution, before it becomes dissipated. After the excess copper is removed, the KPR 3 film may also be stripped. This can be done either mechanically or chemically. Diversey Diverstrip D-90A was found to work very well in removing resist films.

Once the copper is free of the resist coating, it may be protected with an immersion tin deposit. Shipley LT-26 is only one brand of immersion tin solution which is available for this purpose (Step F).

One of the last things I would like to cover is the procedure you can use to coat copper clad stock with Kodak KPR 3 photo-resist. It is not difficult at all. You only need two glass trays (to contain the resist and alcohol), paper toweling (to allow the resist to drain) and an oven (to cure it in).

As with all photosensitive materials, KPR 3 should be handled under Yellow-lighted conditions. As long as it is a liquid, KPR 3 is not photosensitive; once the solvent evaporates and the coating cures, it is sensitive to ambient light.

To begin with, the copper clad stock should be cleaned using a Scotchbrite pad and any type of scouring powder. The stock should be rinsed in water and wiped with a wet sponge. After the excess water has been allowed to drain off it, the stock is immersed in a tray of denatured or isopropyl alcohol. This absorbs water off the board. Allow the alcohol to evaporate from the board stock.

Next, dip the board stock into a glass tray of KPR 3. This can be done in the vertical position, then carefully, the board is removed from the tray, and positioned vertically to allow the excess resist to drain from the board. The coated board is then placed on paper toweling, in a vertical position, where the solvents in the resist can evaporate, the coating level out, and the film air dry. After a 15 minute air dry, place the resist coated cardboards in an oven maintained at 180°F for 15 minutes. After the force cure, the boards may be stored in a light tight box or container, using sheets of paper as separators, and the resisted copper clad stock may be withdrawn as needed in future to fabricate your prototype circuitry.

SUGGESTED READING

"Printed Circuit Handbook," GC Electronics, Available from GC Distributors.

Making PC Boards from the printed page, Thomas R. Rosica, Popular Electronics, October, 1968, page 69.

"Photofabrication of Printed Circuits," Eastman Kodak Publication P-125, $1 from Department 454, Eastman-Kodak Co., Rochester, NY 14650.

Printed and Integrated Circuitry, Materials and Processes, by Sclaback and Rider, McGraw Hill Inc., New York, NY 1963.

Kodak Photo Resist, Type 3, Kodak Publication No. P-86 (1966) Department 454, Eastman Kodak Co., Rochester, NY 14650.

MATERIALS SUPPLIERS

Silk Screen Supplies

Advance Process Supply Co., 400 W. Noble St., Chicago, IL 60622 (312) TA9-1400

Colonial Process Supply Co., 180 E. Union Ave. East Rutherford, NJ 07073 (201) 933-6100

The Naz Dar Co., 1087 N. North Branch St., Chicago, IL 60622 (312) 943-8338

Printed Circuit Boards, Tools, Kits

Allied Electronics, Div. of Tandy Corp. 1355 Sleepy Hollow Rd., Elgin, IL 60120 (800) 323-5240, 323-5450

Newark Electronics, 500 N. Pulaski Rd., Chicago, IL 60624 (312) 638-4411

TABLE I

Drafting aids useful in laying out printed wiring boards. Data is arranged by catalog number, number of images, or feet of tape, and price.

Item	Bishop	Chartpak	Datak	GC Electronics
8 lead	6026	TPCL-11-4	JD-71	21-103
TO-5	250	250	1152	20
(TO-99)	$6.85	$7.55	$6.50	$1.00
14 lead	6014	TPLC-12-1	JD-68	21-120
DIP	250	100	432	16
(TO-116)	$7.55	$9.70	$6.50	$1.00
.125"	D207	TPCC-72	JD-124	21-023
round	500	250	4464	125
pad	$3.00	$1.00	$6.50	$1.00
.187"	D138	TPCC-72	JD-125	21-025
round	500	250	3120	126
pad	$2.00	$1.00	$6.50	$1.00
.250"	D109	TPCC-77	JD-127	21-025
round	500	250	1920	126
pad	$2.00	$1.00	$6.50	$1.00
.020"	T201	TP-1502	- - -	21-002
tape	720	648	- - -	360
	$ .75	$ .70	- - -	$ .59
.040"	T201	TP-0401	- - -	21-004
tape	720	648	- - -	360
	$ .75	$ .75	- - -	$ .59
.080"	T201	TP-0801	- - -	21-006
tape	720	648	- - -	360
	$ .75	$ .75	- - -	$ .59

Bishop Graphics, Inc. 7300 Radford Ave., North Hollywood, CA 91605

Chartpak Rotex, One River Road, Leeds, Massachusetts 01053

Datak Corporation, 85 Highland Ave., Passaic, New Jersey 07055

GC Electronics, 400 South Wyman Street, Rockford, Illinois 61101

Kepro Circuit Systems, Inc. 3630 Scarlet Oak Blvd., St. Louis, MO 63122 (314) 225-5166

Photosensitive Exposure Film

The 3-M Co., Reflective Products Division, Minneapolis, Minnesota

Scotchcal Exposure Film #8007, ten sheets, 10" x 12"; Scotchcal Developer #8500

Available through : Lysinger Photo Supply Co. 30391 Stephenson Highway, Madison Heights, MI 48071

Kodak Photoresist Materials

Eastman Kodak Co., Rochester, NY 14650

KPR Type 3 Rist, KPR Developer

Resist Stripper

Diversey Chemical, Div. of Diversey Corp., 1855 S. Mt. Prospect Rd., Des Plaines, IL 60016 (312) 297-7500

Diversey Diverstrip D90A

Copper Cleaner and Deoxidizer

Shipley Co., Inc., 2300 Washington St., Netwon, MA 02162 (617) 969-5500

Neutraclean 68, LT-26 Immersion Tin

Ferric Chloride & Solvents

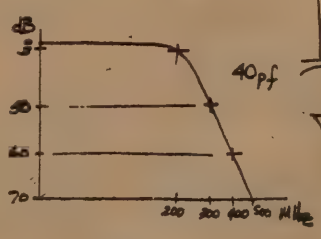
Haviland Chemical Products Co., 421 Ann St NW, Grand Rapids, MI 49504 (616) 361-6691

Ferric chloride, 42° Baume' Photoengravers Grade; Isopropyl alcohol; Trichloroethylene

Laminates

Novel Products, 4335 Clyde Park SW, Grand Rapids, MI 49508 (616) 532-2388

Epoxy-Fiberglass Laminate, one ounce copper clad/one side; one ounce copper/two sides/ two ounce copper/one side



2 METER LOW PASS RF FILTER
DUAL PI-SECTION DESIGN

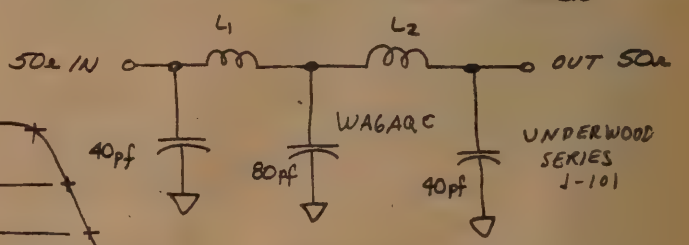


TABLE II

CONDUCTOR CURRENT CAPABILITY

Copper		Per Foot		Equivalent
Thickness (Inches)	Width (Inches)	Resistance (Milliohms)	Current (Amperes)	AWG (to Nearest Size)
.00135	.010	450	0.8	- -
(1 oz.)	.015	400	0.9	- -
	.020	300	1.2	- -
	.025	250	1.4	34
	.050	125	2.3	31
	.075	85	2.9	29
	.100	60	3.6	28
.00270	.010	230	1.1	33
(2 oz.)	.015	200	1.2	33
	.020	150	1.5	32
	.025	130	1.8	31
	.050	60	2.8	28
	.075	42	3.7	26
	.100	30	4.6	25
.00405	.020	100	1.8	30
(3 oz.)	.025	80	2.1	29
	.050	40	3.3	26
	.075	28	4.3	24
	.100	20	5.4	23
	.150	13	7.4	21
.00540	.030	50	2.6	27
(4 oz.)	.050	30	3.7	25
	.075	20	4.9	23
	.100	15	6.2	22
	.150	10	8.2	20
.00675	.035	35	3.2	25
(5 oz.)	.050	26	4.0	24
	.075	17	5.6	22
	.100	12	7.0	21
	.150	8	8.9	19
.00810	.050	20	4.3	23
(6 oz.)	.075	14	6.0	21
	.100	10	7.4	20
	.150	7	9.4	18

NOTE: 1) For intermediate widths not shown, extrapolate linearly.
2) Minimum widths shown for each thickness are practical limits.
3) Single conductor, steady state current, 10°C rise from 20°C ambient.

KLM Superior-Quality VHF and UHF Antennas

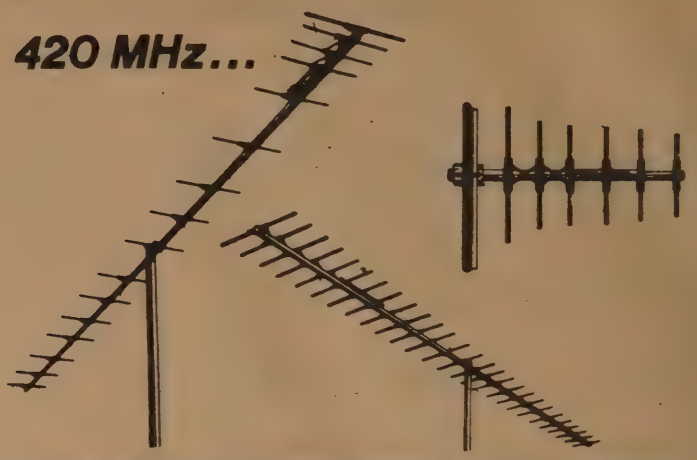
2 Meters...

Two-meter beams deliver maximum gain and clean patterns, with VSWR of less than 1.2:1 across the entire 144-148 MHz range. High grade insulating materials, weather-resistant aluminum boom and elements. 12, 14 and 16-element beams make outstanding moon-bounce building blocks.

16-Element
KLM-144-148-16 $99.95

Gain: 14.8 dBd. Beam width at 3 dB pt.: 16 degrees. Feed Feed impedance: 50 ohm balanced (KLM 1:1 Balun, 144-148-50 optional). Boom dia.: 1½". Boom length: 20.66'. Max. mast size: 1½". Center mounting. Wt.: 10 lbs.

420 MHz...



A versatile series of KLM beam antennas in a variety of configurations: broadband rear-mount type for horizontal or vertical arrangement, ultra-high-gain DX type, and optimized long boom Yagi for narrow-band use. All have VSWR less than 1.2:1 across the entire band. Maximum mast size: 1½".

6-Element
KLM-420-470-6 $26.95

Frequency: 420-470 MHz. Gain: 8 dBd min. F/B ratio: 20 dB min. Beam width at 3 dB pt.: 30°. Feed impendance: 50 ohm balanced (Balun 420-470-50 optional). Boom dia.: 1". Boom lgth.: 2'. Mounting: End or center; horizontal or vertical. Weight: 1.2 lbs.

14-Element
KLM-420-470-14 $46.95

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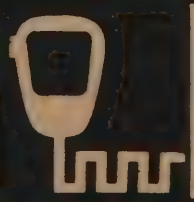

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SSTV video

A5 Amateur Television Magazine

Mike Stone, WBØQCD
P.O. Box H, Lowden, Iowa 52255

With the recent surge of popularity in Slow Scan Television largely due to commercially available "converters", current newcomers to SSTV should be reminded that many of the effects now being used and experimented with such as COLOR SSTV, 1/2 speed frame rates, 256 line resolution, double and triple memories and motion (MSTV) SSTV were pioneered by early ATV experimenters who rarely get their names mentioned in recognition when these subjects are being discussed on 14.230 or 28.680 Mhz.

3 memory COLOR SSTV was "gloriusly" featured in a recent issue of QST MAGAZINE in an article by G3NOX and G3WW in England. (Reprint appeared in A5 MAGAZINE January/February 1981 issue). But it was ATV pioneers like WØLMD Robert Suding, WB9LVI George Steber, W6MXV Mike Tallent & W9NTP Don Miller and others who first offerred "DIGITAL" SSTV in 1975. A 3-COLOR SSTV system was demonstrated at the 1976 Dayton Hamvention using a unique "color wheel" that gave five resolutions per second, four fields of green, four fields of red and four fields of blue. The loading of each individual memory took 1/5 second and an additional FSTV ouput in the 450 band could be accomplished in COLOR viewing at the normal 60 hz. rate. This demonstration was by W9NTP based on the newly introduced digital system design for SSTV by WØLMD. W9NTP took the further steps in COLOR SSTV in a 2-COLOR SYSTEM designed to aid more SSTV'ers in financial savings using double memories with the aid of an additional board and still receive and transmit COLOR SSTV. This double memory article appeared in several issues of A5 MAGAZINE two years ago. Even today, the "search" is on to see who comes up with the first 3 memory converter, (Volker Wraase's SC422 ssytem has two) and the dream of a single frame COLOR transmission has been talked about in the 1980's. I suggest interested readers research back issues of A5 MAGAZINE especially March/April 1976 (page 32) where Mr. Miller talks about the "utimate" system using a double sideband orthogonal subcarrier of 500 hz. producing a single frame COLOR transmission system that was demonstrated at that years Dayton Hamvention.

STEREO TV Never heard of it? Want to be a pioneer in another great extension of ATV? Two memories can be loaded from two identical cameras spaced five inches apart with each camera system looking through different color filters producing stereo pictures. Think of the possibilities? Volker Wraase's SC422 two-memory system now available to U.S. Amateurs would be an ideal experimenting unit. Want to go a step further? If this method is viewed on a color TV monitor on either SSTV or FSTV through colored glasses (one eye red filter and one eye green filter), the viewed image will show 3 DEMENSIONS! I can see it all now...Robot 3D SSTV Glasses advertised by Wayne Green as the "in thing" for SSTV'ers.....

A5 MAGAZINE publisher KB9FO Henry Ruh published long ago about modifications to existing Robot 400 units for 1/2 speed transmissions and 256 line reception. Do you hear anyone on the band using this method? A surge of 1/2 speed 16 second SSTV transmission was heard in early 1980 after an article appeared in A5, but has not been heard from again. 128 lines by 128 pixels sent at 1/2 speed rate has been proven to provide better QRM free pictures on all bands especially 80 meters where multipath dominates. (See A5 article on Robot 400 modification in March/April 1980 issue or send author SASE).

MEDIUM SCAN TELEVISION How many SSTV'ers besides W9NTP, G3WW and a handful of others took the interest and time to monitor Don Millers 29.150 Mhz. Medium Scan transmissions? The F.C.C. awarded Miller with a limited authorization of testing on MSTV and many artciles trying to spark interest among current enthusiasts. Those of you going to Dayton this year should be sure to stop by and see what is happening to ATV. Rumors of a "German" SSTV converter with three memories for Color just might be verified.

I guess the point I am trying to make is this. Let's not get all caught up in the "rich" mans game of buying 3 converters, a color TV monitor etc. and search for ways to take what our "brother" pioneers gave us and find cheaper ways of obtaining the same end result. Also give credit where credit is due to those who deserve it! Enjoy!

Fast Scan TV-SSTV

video DX

A5 Amateur Television Magazine

Mike Stone, WBØQCD

P.O. Box H, Lowden, Iowa 52255

A special report

- January SSTV Contest Results!
- Dayton Hamvention A5 get-together
- K6AEP Software for Radio Shack COLOR 6809
- SC422 New "Light Pen" by Volker Wraase
- SSTV Mobiles
- Eastern Iowa ATV/Balloon Rally

KC2Q Mike Di Persio of Bradley Beach, New Jersey took first place in the January SSTV Contest sponsored by A5 TELEVISION MAGAZINE. For a relatively unknown contest in its' first outing, Mike racked up 21 hours of 41 qso's with 410 points and 1,090 points in bonuses= 1500 points to lead all contenders. KC2Q worked 19 states, 2 provinces, 9 countries and sent 41 mugshots. Mike used a combination of persistance as well as racking up the points on video sent as per the design of the unique contest. This proves that this type of contest was much more enjoyable to participate in and still have a winning score. CONGRATULATIONS Mike! Your years' free subscription is in the works. KB9FO Henry Ruh will be in touch with you. See you next year! For those of you who missed the "INTERNATIONAL SSTV CONTEST" and guidelines see NOV/DEC issue of A5 MAGAZINE. Other mentioned entries WBØWKQ Dan in New Virginia, Iowa took 2nd place with a total point accumulation of 1,290--WAØOQA Dick in Scott City, Kansas had 805 points for 3rd place--leading the numerous DX entries was HB9AYX Deoaunes Bernard of Epallnges, Switzerland with 640 points. Thanks for your excellent efforts Deoaunes! Other entries were received and too numerous to mention. Thanks to all who participated and pass the word for next year! The 73 MAGAZINE SSTV Contest in March should be another good one. I just hope that they get their act together this year on award certificates... All ATV'ers, wether SSTV or FSTV, are encouraged to join us at the Friday and Saturday night get togethers at this years Dayton Hamvention. See you at Henry and Tom's booth!

28.680 is bristling with activity on weekends with Clay Abrams K6AEP talking about his new software packages for Rtty and SSTV for Radio Shacks new 6809 MicroCOLOR computer. It has 10 memory graphic capability, 8 shades of grey scale and other features. Write Clay for details at 1758 Comstock Lane, San Jose, California 95124.

DL2RZ Volker Wraase and KW Control Systems in Middletown, New York announce availability to US stations for the SC422 SSTV system a video "light-pen" that draws (pixel change) on your TV set. See A5 review in NOV/DEC issue for details. The SC422 system will be at Dayton, Ohio.

I have worked alot of you on my converted 10 meter rig (Midland 13-893 SSB) and you have seen my video slow-scan generated by a portable GE cassette. At 4 or 5 watts, alot of fun can be had while running around in the mobile. Get those 10 meter rigs on SSTV! See you on 28.680 Mhz.

The EASTERN IOWA ATV SOCIETY held an ATV demonstration party in the dead of winter on Valentines Day in February in Stanwood, Iowa near Cedar Rapids. The Amateur hobby was combined with Hot Air Balloonists of Iowa to provide communications and video from Hot Air Balloons. An article will follow with pictures and details on the groups outing! Congratulation go to WBØKFB Jim Buttlemen for building and demonstrating a completely portable 439.25 system using portable batteries and camera. Iowan ATV'ers on FSTV are enjoying videocassettes from Bloomington, Ind. and California ATV'ers as they are swapping tapes. Other groups wishing to do the same send VHS 2 hour format tapes to Live Video, PO Box H, Lowden, Iowa 52255. (WBØQCD) My personal thanks to Bob and Joe at K9KTH/R Bloomington ATV'ers and Diane WA6MVD and Mike WA6SVT in California for getting me very interesting programmed videocassettes to use for our Davenport, Iowa hamfest and ATV demonstration on March 1st. Return tapes are being made and coming your way! This makes for a unique method of "seeing what is happening" in other ATV areas. Let's get together!

Any ATV'ers around Herb Brown W2HF now of Independence, Kansas? Write to him, he is looking for activity; RR2, E. Wingard Road. W7AMQ and W7KPW encourage SSTV'ers to make more use of the OSCAR 8 Satellites orbits. The have already logged several contacts on SSTV! WB9MCF Ron from Burnside, Illinois reports several station getting on ATV; WBØLXV, WBØTNO, WAØOTA, WD9DJJ and WB9YHS. Ron worked ZS6ATA long-path on Sept. 18th on SSTV a distance of about 20,000 miles!

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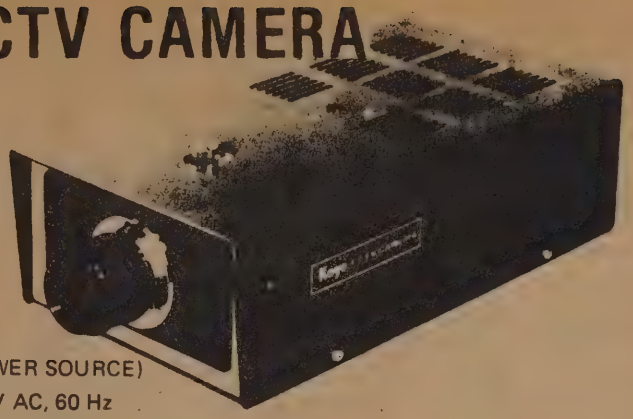

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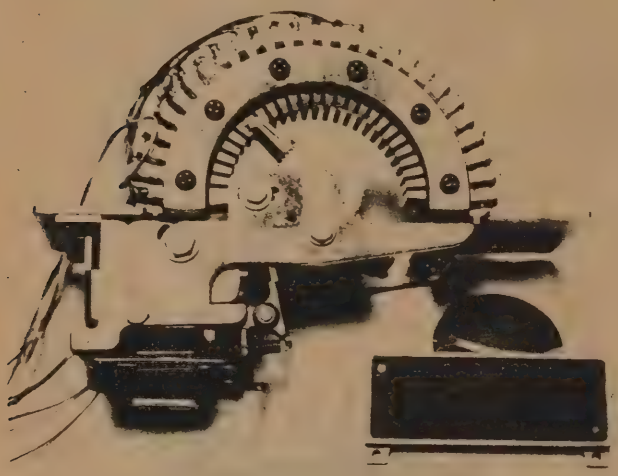
VISA

LED THEORY AND APPLICATIONS

B. Wierenga, LSI Sr. Engineer

To fully appreciate LED's it would be well to take a short look at the history of displays and why the technology has progressed as far as it has. The need for digital readouts has been with us a long time, but the usage was very restricted by the technology.

15 years ago Lear Siegler was making electroluminescent displays for the Apollo Spacecraft. If a person at that time had the brilliant idea of making a Digital Clock, and looked at the state of the art of components, he might have picked items as shown in figure 1. A stepping relay driving an electroluminescent display was actually our approach to making a digital clock 15 years ago.



DIGITAL CLOCK COMPONENTS

FIGURE 1

Things are different today. The integrated circuits which we have today make digital circuits with digital readouts a household item. Who would have imagined that we would be buying fou function calculators for $12.

We will take a quick look at existing display techniques before we concentrate on Light Emitting Diodes. Nixie Tubes, Magnetic drums, and projection displays have been replaced by the following techniques which are furnishing the displays for most applications: Liquid Crystal Displays, Gas Discharge Displays, Incandescent Displays, Vacuum Fluorescent Displays, Cathode Ray Tubes, Light Emitting Diodes.

On paper, Liquid Crystal Displays appear to be the "ideal" display. They require only nanoamperes to switch which make them ideal for battery operated devices such as watches or multimeters. They are a reflective display which means that the contrast between an "off" and "on" segment is obtained by a reflection of the ambient light.

There are two basic types of liquid crystal displays. The first to appear was the dynamic scatter LCD. It was later followed by the field effect LCD. This type is most generally found in wrist watches and the display can either be black segments on a light background or the opposite white segments on a black background.

These displays are quite inexpensive to manufacture; however, some unexplained phenomena have occurred in manufacturing and somewhat limit the applications. They also have a longer time constant than some displays and are limited in operation at low temperature.

Gas Discharge Displays are found in many applications. They also come in two types, a DC device where current conduction takes place between a cathode and anode and a glow exists as the gas is ionized. In the AC type, a charge is built up on the walls of the device and a glow exists as the electric field is switched and the gas is ionized. This type of glow has a very uniform appearance over the conducting plates. This type of display is very readable and they are relatively easy to manufacture. The high voltages required to operate restrict their application in some cases.

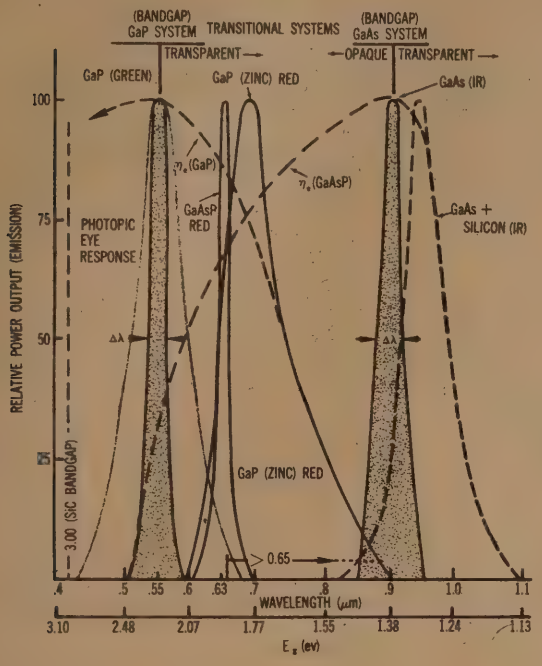
Incandescent Displays also come in different configurations with the most popular being either a light pipe type where the segments are formed by a light pipe going back to a single incandescent lamp or another type where the filaments themselves form the segment. These displays are highly readable and are used in most of the Controller applications here at Lear Siegler. They are not a solid-state display; hence, the filaments will eventually deteriorate as any other lamp bulb.

Vacuum Fluorescent Displays are also found in many applications. The emitted light is generated by electrons striking a phosphor surface and emitting light. This is no different than a cathode ray tube; however, the anode is flooded by many electrons and forms the lit segment. No deflection of the electrons is necessary. The anode voltage is fairly low, however, (40 volts max) so they can be easily used in many applications and are quite cheap.

Conventional Cathode Ray Tubes can be used to display alpha-numeric if large quantities of data are presented. This technique, however, is much more expensive than any of the other devices and is quuite often found in readout devices for computers.

We will now concentrate on Light Emitting Diodes (LED's). The first question we will deal with, is -- What is an LED? An LED is a PN junction semiconductor device which will conduct current by the same recombination mechanism as any other semiconductor. Electron energy is released

in the form of a light photon when the band-gap transition is made from the conduction band to the valence band. The wave length of the photon, hence, the color of the light, can be altered by the material used. As an example, figure 2 shows the wave length of various materials and the response of the human eye.

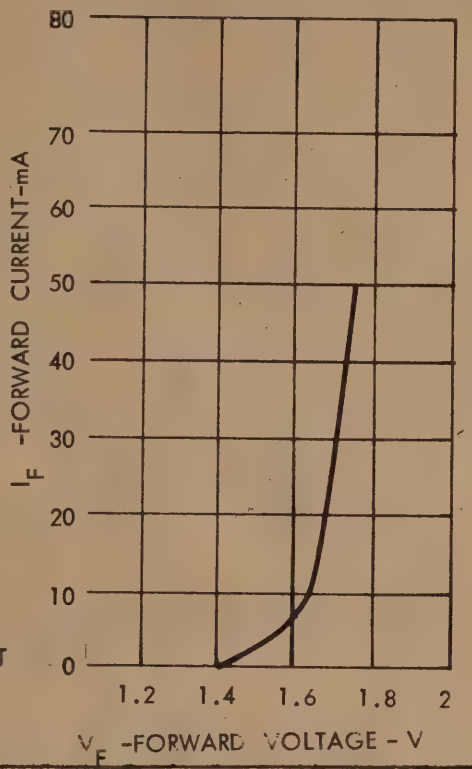


SPECTRAL RESPONSE OF VARIOUS MATERIALS

FIGURE 2

Electrically an LED is no different than a conventional diode, hence, if you would put one on a curve tracer you would see a curve as shown in figure 3. For various materials the energy gap differs, hence the various forward voltage characteristics as shown in figure 4. In some cases such as the MAN 1, the forward voltages will be abouut 3.0 volts which indicates that the chips forming the segments are in a serial parallel arrangement which accounts for twice the forward voltage.

FORWARD CONDUCTION CHARACTERISTICS



FORWARD VOLTAGE VS FORWARD CURRENT

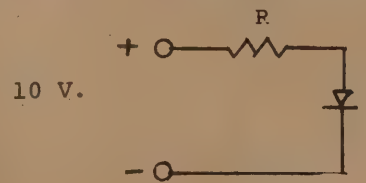
FIGURE 3

Since we are concerned with an opto-electronic device, we must also consider the optical properties in order to evaluate the efficiency of the LED. The optical efficiency varies as the type of material, hence we will first consider Gallium Arsenside Phosphidewhich generally emits light about 655 nanometers.

Three factors contribute to the loss of photons which reach the eye. First the GaAsP material is quuite opaque and absorbs 85% of the photons which are emitted at the junction. Secondly, we have a loss due to the reflections caused by the different indices of refraction in GaAsP and in air. The third loss occurs due to the internal reflection of photons incident at angles greater than the critical reflection angle. This can be improved by using a domed surface.

The Gallium Phosphide diode peaks at about 700 nanometers and has an optical advantage in that the GaP material itself is more nearly transparent to Red Light. This type of diode is often used in a numeric display which diffuses the light from a single chip to form the segment.

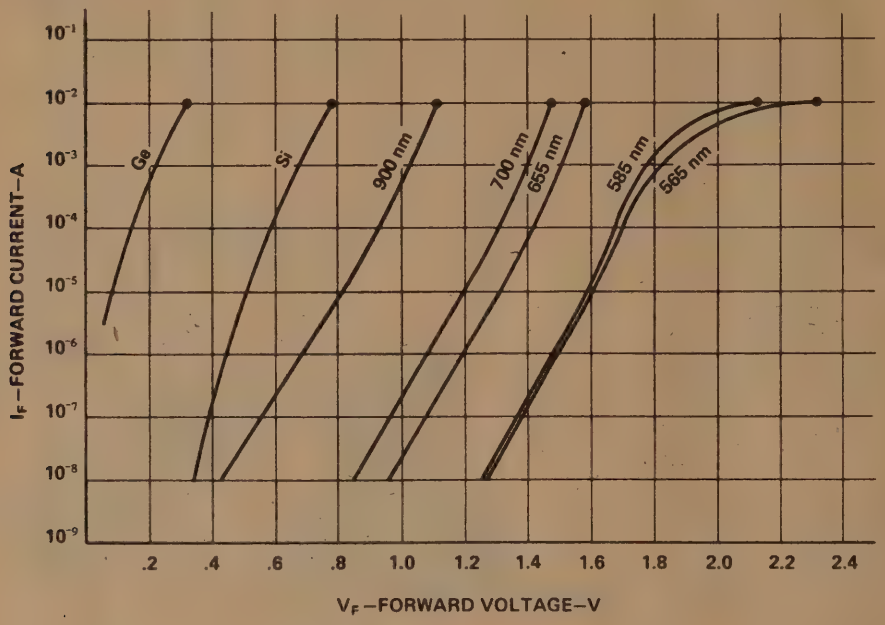
How can LED's be used? Since LED's are semiconductors we can use many of the same techniques used in transistor and diode design. This involves becoming familiar with the specifications. A few illustrations from data sheets are shown in figure 5. A curve of forward voltage versus forward current gives us an indication of how we should supply current to the device. The sharp knee at 1.6 volts suggests that we should ideally supply our current from a constant current supply, hence we should use a series limiting resistor to soften the souurce. If we choose a supply voltage of 10 volts and our forward drop was 1.6 volts and we wanted to supply 20 ma, we can easily calculate our resistor value.



$$R = \frac{10-1.6}{0.02} = 420 \text{ ohms}$$

Now we could go to the brightness versus forward current and get an idea how much light is emitted from the display. Ideally it would be nice to have our units of light intensity in electromagnetic radiation units such as milliwatts but life is not that simple. Since the eye is involved in the response, we must go to Photometric units. Here we encounter the foot lambert or the millicandella which only the brave try to convert to radiation figures. Photometric units and their conversions are complex subjects by themselves.

Now that we have a device which is emitting light, we may look at other things such as the effects of temperature, its reverse voltage characteristics in case we do want to use its



Diode Current - Voltage Characteristics

rectifying properties, or its spectral characteristics. Most specification sheets contain this type of information. Data sheets on Monsanto and Opcoa devices are in your handout package.

The discrete display is the simplest of display devices and might be used in an equipment status application such as power on/off, output high/low, relay closed/open or teletype mark/space. Our solid state circuitry now can also have solid state readouts which greatly improves its lifetime.

The next LED application we will consider is a numeric display where segments of light emitting diodes are used to form the numerals from 0 to 9, figure 6. Here we can look at the same parameters on the data sheets with a few added considerations.

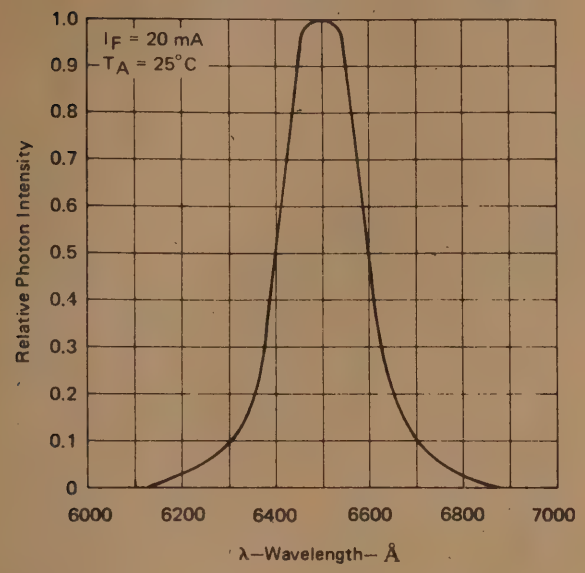
Since we are dealing in a decimal system we would most likely get the display data in a Binary Coded Decimal format. This means that we have four lines of digital data containing coded information for each character of the display. A simple truth table can be constructed to indicate which segments should be lit. Figure 7 is the truth table for a device called a seven segment decoder which performs this conversion for us. Several types are available in integrated circuits such as those listed: Fairchild, 9301, 9307, 9317, 9325, 9327, 9337, 9352; Motorola, MC7441A, MC7442, MC7446, MC7447, MC 7448; National, DM8840, DM8842, DM8846, DM 8847, DM8848; Texas Instrument, SN7445, SN7446, SN7447, SN7448, SN7449.

If we were making a four-character display we would have the option of using four BCD-to-seven segment decoders or just one in a time shared mode. This is shown chematically by figure 8. If the time-shared mode is selected, we must consider the effects of driving LED's in a pulsed fashion. Most hand calculators use time-shared drive for the display.

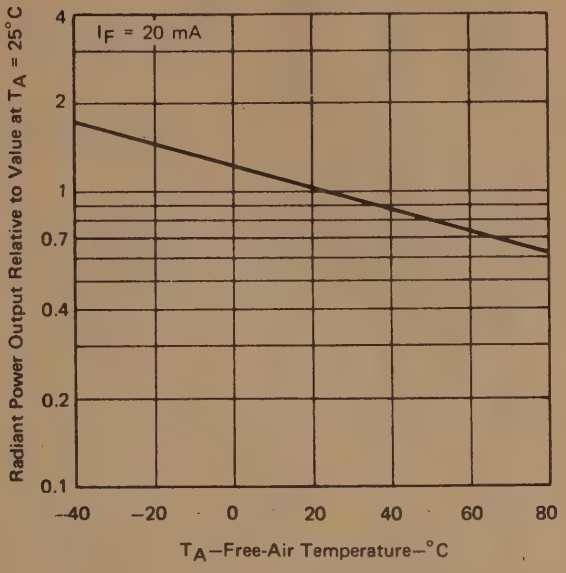
The brightness vs. current curve for a GaAsP diode is shown in figure 9. Generally this curve is somewhat super linear which indicates that if the device is driven by pulses of current the average light output will be somewhat higher than expected. Two things must be considered: first the saturation of the brightness with current and secondly that the maximum current rating is not exceeded for temperature considerations of the chip itself.

TYPICAL CHARACTERISTICS

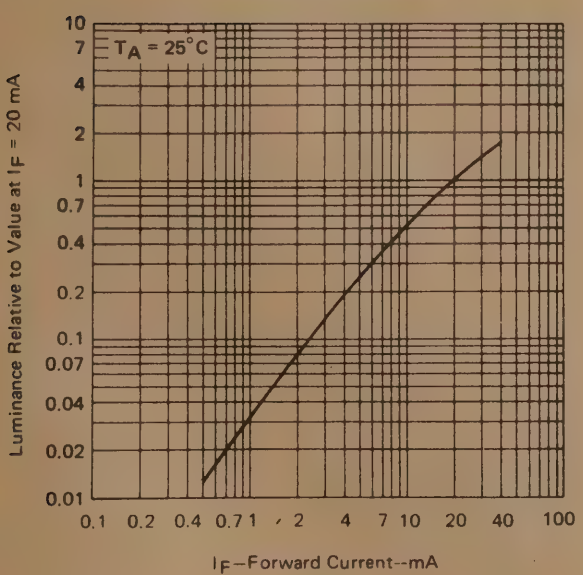
RELATIVE SPECTRAL CHARACTERISTICS



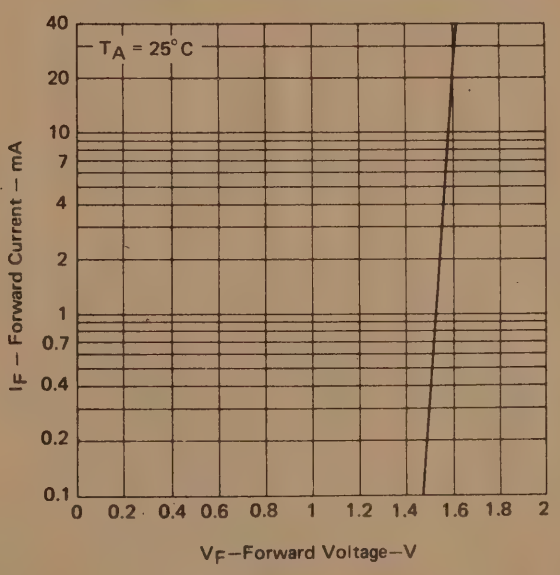
RELATIVE RADIANT POWER OUTPUT
vs
FREE-AIR TEMPERATURE



RELATIVE LUMINANCE
vs
FORWARD CURRENT



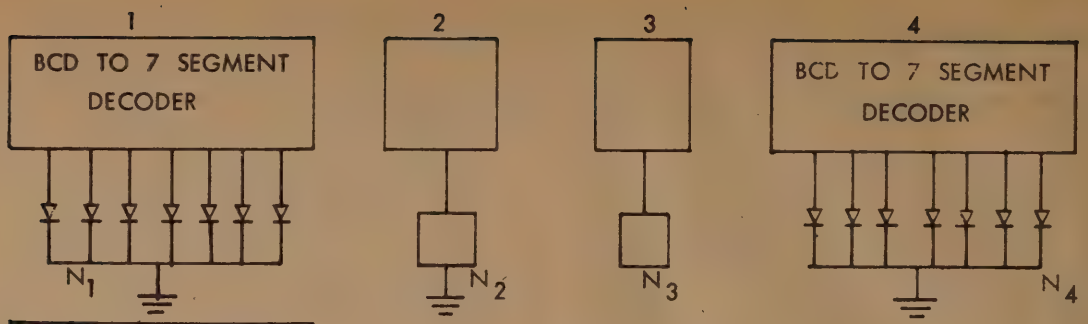
FORWARD CONDUCTION CHARACTERISTICS

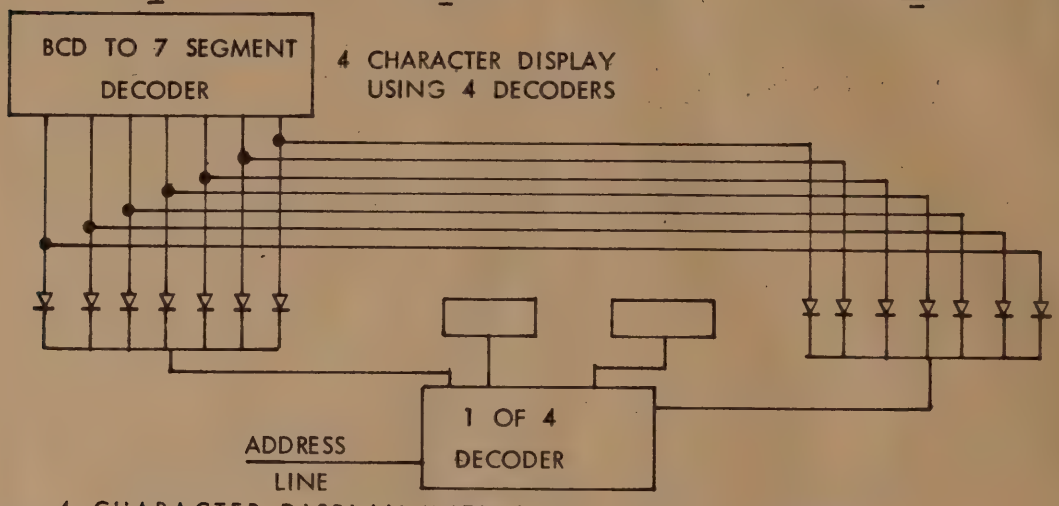


Typical Data Sheet

Fig. 5

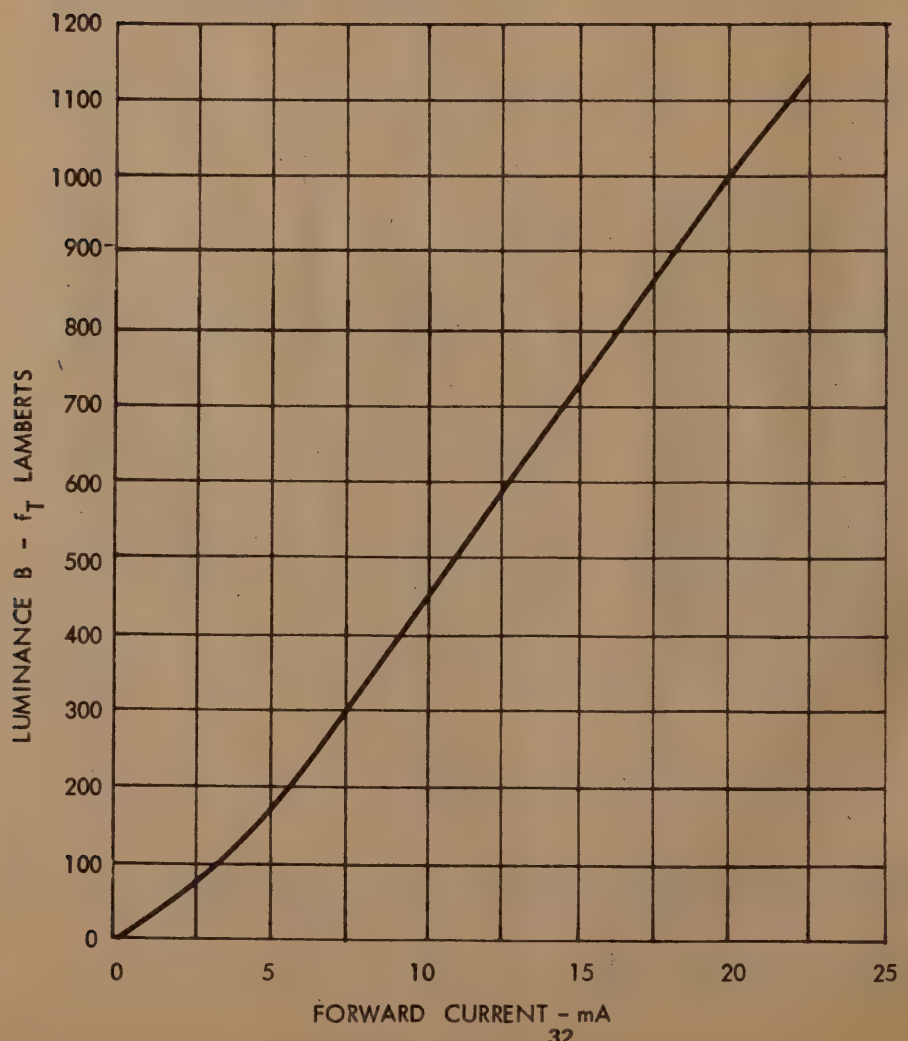
IF ITS VISUAL ··· ITS IN A5!





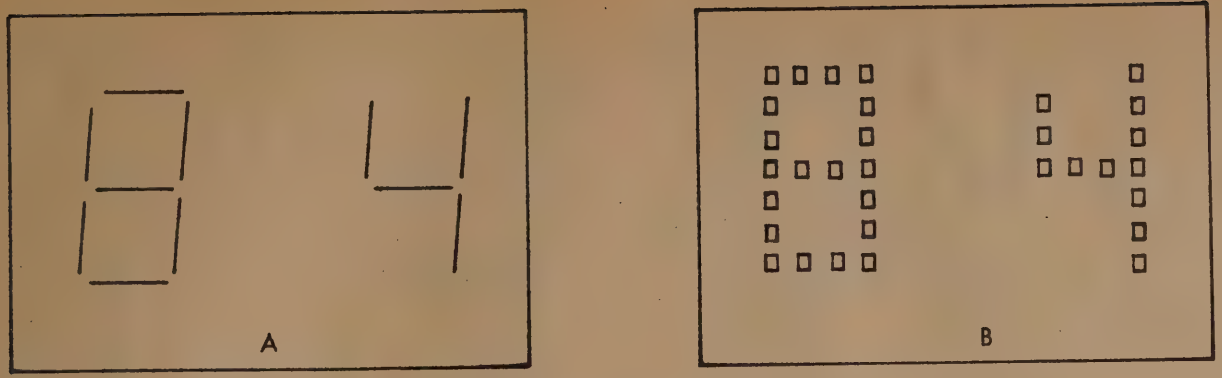
4 CHARACTER DISPLAY USING 4 DECODERS

4 CHARACTER DISPLAY WITH TIME SHARED DECODER



BRIGHTNESS VS FORWARD CURRENT

FIGURE 9



NUMERIC DISPLAY FONT

FIGURE 6

BCD INPUT				5082-7300/02	5082-7340
X_8	X_4	X_2	X_1		
L	L	L	L	0	0
L	L	L	H	1	1
L	L	H	L	2	2
L	L	H	H	3	3
L	H	L	L	4	4
L	H	L	H	5	5
L	H	H	L	6	6
L	H	H	H	7	7
H	L	L	L	8	8
H	L	L	H	9	9
H	L	H	L		A
H	L	H	H	(Blank)	B
H	H	L	L	(Blank)	C
H	H	L	H	—	D
H	H	H	L	(Blank)	E
H	H	H	H	(Blank)	F

BCD to 7 Segment
Truth Table

Fig. 7

The next possibility for a display is one which has fuul alpha numeric display capabilities, that is, can display both numbers, letters and other characters. Two types of displays are used - a sixteen segment stick type, figure 10; or a matrix made up of 35 LED chips arranged in 5 columns by 7 rows, figure 11. This type of display is usually driven by a standard ASCII code which is familiar in teletype applications. The decoding is usually programmed in a Read Only Memory device which is available in Medium Scale Integrated circuits. This type of display is usually time-shared.

As the familiarity with LED increases, so will the ability to devise unique circuits for using them. Following are a few circuits that very simply take advantage of having a solid-state display.

First the device can be used as a line on/off monitor for either AC or DC. The big advantage is reduction in heat. Figure 12 shows the application where a series resistor limits the current. In this case the positive voltage is applied to the anode so a forward current flows through the device. This can also be used as a continuity checker. For operation on an AC line, we could add a protective clamping diode as in figure 13. Here we have half-wave current flowing through the diode, hence we use a factor of 2 in the demominator of the equation to give a brightness equal to that of DC.

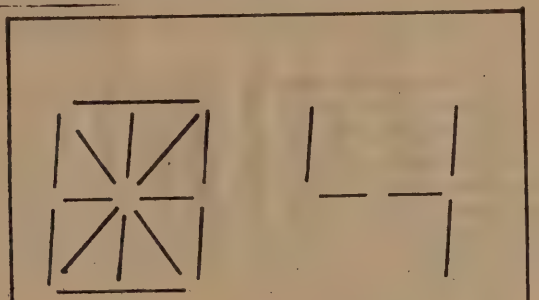


FIGURE 10

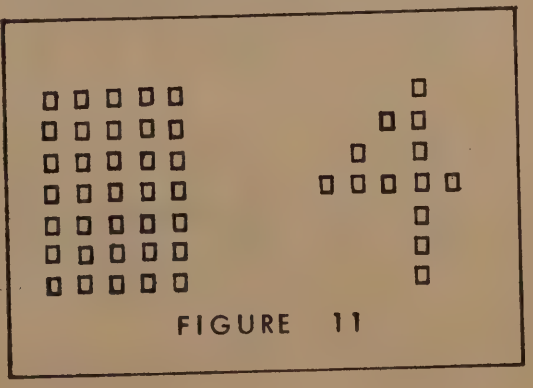
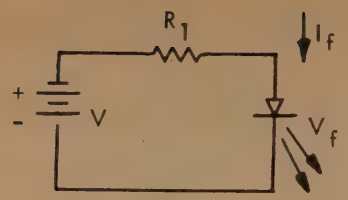


FIGURE 11

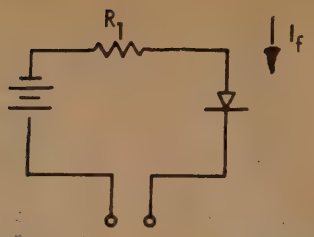


DC OPERATION

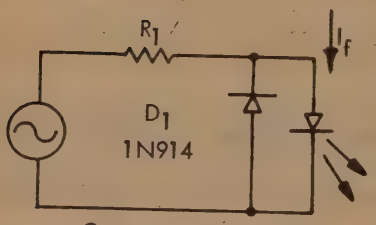
LINE ON/OFF MONITOR

$$R_1 = \frac{V - V_f}{I_f}$$

FIGURE 12



CONTINUITY CHECKER



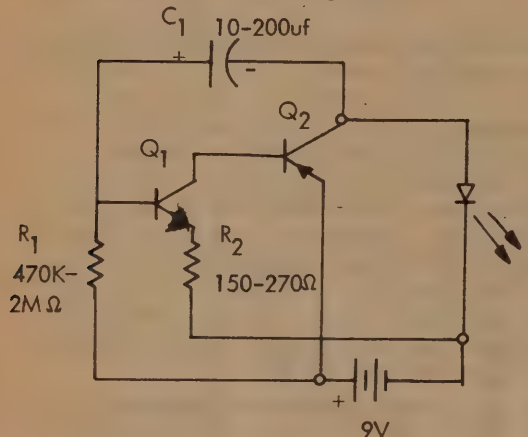
LINE ON/OFF MONITOR - AC OPERATION

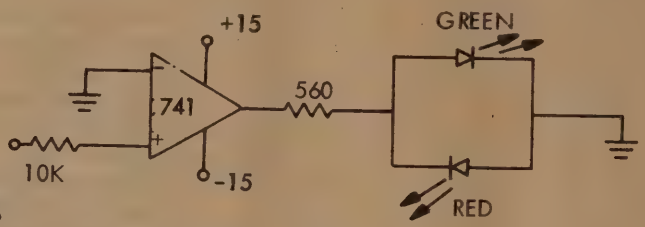
FIGURE 13

$$R_1 = \frac{V_{rms} - V_f}{2I_f}$$

POLARITY INDICATOR

FIGURE 14



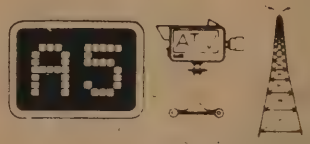


L E D FLASHER CIRCUIT

FIGURE 15

A polarity indicator might be a useful device when monitoring the status of a transmission line. The circuit of figure 14 shows how this could be achieved using a 741 op amp. With a positive input, the op amp output is positive and the green light lights. When the input goes negative, the output also goes negative and the red light lights. A Monsanto MV 5491 (red/green) LED can be used.

Up to now, we have not mentioned the fast response time of LED's. Unlike incandescent lamps which have a characteristic thermal time lag, LED's have a response such that they can be used in applications up to many KHz. A simple flasher is shown in figure 15.



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MEDIUM SCAN TELEVISION NEWSLETTER FROM W9NTP

As mentioned in previous newsletters, the Special Temporary Authorization (STA) permission from the FCC which has been in effect from 1978 has been renewed by the FCC for an additional 2-year period. The original five amateurs plus one additional one has been given permission to transmit MSTV on 29.150 KHz with a maximum bandwidth of 36 KHz. These six amateurs are: WØLMD, W9NTP, WB9LVI, W3EFG, W6MXV, NØAB. During these two years additional amateurs can be added to the list for transmission. Each case will be considered by the FCC when permission is requested. I will be glad to work with anyone in preparing your request if you will enlist my help.

Mathematical analysis shows that the maximum field rate that can be used for MSTV under these bandwidth restrictions is 2 fields per second for a 128 pixel by 128 line television picture. This results in a base video bandwidth of 16 KHz. One exception to this is the use of wideband single sideband. This will be considered in due time when a source of filters is located.

Since the last newsletter, various motion formats have been tried in the laboratory and some of the best ones have been chosen for further test. These tests have shown that if the full raster is transmitted that it is necessary to have an effective field rate of at least 7.5 fields per second to give the illusion of reasonable motion. The 7.5 fields per second can be easily achieved by field grabbing at one-eighth of 60 fields per second. The base bandwidth of such an image is 64 KHz which is far beyond the capabilities of the allocated 36 KHz RF bandwidth.

Some years ago, one of the MSTV investigators, W3EFG, developed a bandwidth reduction system called Sampledot for his employer, General Electric Co. at Valley Forge, PA. The scheme was demonstrated in various mechanizations for several years. Sampledot works on the principle of only transmitting a fraction of the total number of pixels during any fast scan (60 Hz) field time. The chosen pixels for transmission are sampled from many small areas that are repeated many times throughout the total field time. The samples are sampled in a pseudo random fashion to reduce any repeated lines or edges that could result in even sampling times.

The result is that since each pixel is not transmitted every time the original field is scanned, the chosen pixels can be stretched in time or boxcarred to reduce the base video bandwidth. The total number of pixels will be sampled after many pseudo-random passes through many different 60 Hz field times. The effect is to give continuous motion on a one field pass basis but to include many passes so that the image viewed by the receiver will show a constant update of new dots.

Bob Stone, W3EFG, worked from a 60 Hz image and reproduced the resampled received pixels on a real time television monitor. The image had reduced brightness and gave an interesting image that was satisfactory for many purposes. The integration of the phosphor gave continuous motion and enough time lag that the eye was able to integrate the many pixels that were being supplied to the monitor. Keep in mind that this was a usable real time system. The bandwidth was less than 600 KHz and could be transmitted on the 400 MHz band. It was tested through commercial and military satellites.

The military showed some interest in the system during the test period and while working for the Navy, I added a complication to the system in hopes of providing a brighter picture and the possibility of signal processing. This complication was the digital scan converter or frame store memory.

The use of a digital scan converter for storing the picture, in lieu of monitor phosphor decay, made a brighter picture but added another defect called the "Star Trek Effect." This defect appeared as a "teleported image" with the image forming and breaking up in a flurry of dots from nowhere. It is of course possible to electronically control this build-up of the image by signal processing to produce a synthetic electronic phosphor. This was done several times with more interesting results. About this time, Bob assumed other responsibilities at another location in the General Electric Co. down in Florida. The military interest changed to other forms of bandwidth reduction with "transform methods" assuming the greatest importance.

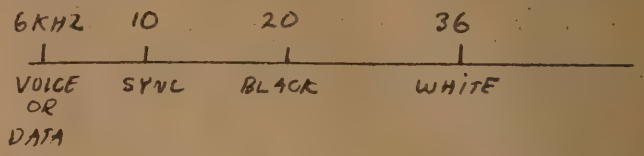
Recently in the Navy laboratory where various forms of adaptive picture bandwidth reduction was being tested, we set up the old "sampledot" scan converter which had also been converted to be a field grab system for comparison system. In addition, other digital scan converters were available to make it possible to demonstrate both sampledot and field grab simultaneously. Remember that W3EFG always used real time television at 60 Hz field rate for his sampledot image. The use of a digital scan converter makes it possible to use other field rates for further bandwidth reduction. These two scan converters were coupled together to allow the demonstration of a sampledot image derived from a 7.5 Hz field grab image. The image that viewers liked in terms of minimum bandwidth was a 4/1 sampledot image at a field rate of 7.5 Hz. This gives a potential bandwidth reduction of 8x4 or 32. When divided into the 60 Hz field rate of the source television, it results in an effective field rate of 2 fields or a base video bandwidth of only 16 KHz (Our objective for a transmission capability of 36 KHz RF bandwidth). I might also say that we are still discussing a low resolution image of 128 by 128. Eventually we feel that the image should be 256 pixels by 128 lines. This means that

the base bandwidth will be 32 Khz. If it eventually works out to use wideband single sideband, the system of field grab sampledot will work out very well. Remember that no one has built this system yet. The construction is quite simple if you own a two memory Robot 400. Read Jan 1981 QST for how this can be accomplished.

A better understanding of sampledot can be had by considering that the 128 x 128 image is divided into 32 x 32 blocks consisting of 4 pixels and 4 lines in each block. Each square therefore has 16 dots. As the image is scanned line by line, one dot is chosen from each block resulting in 32 samples per line. During the next line a different dot is chosen but is the same dot in each of the 32 blocks through which the line goes. This continues for two more lines. At this time line 5 is in a different block and the same dot in each block along the fifth line is chosen that was sampled for line 1. The pattern repeats for 32 blocks along the vertical direction. During the next field time (7.5 Hz in our case) a different dot is chosen for line 1 than was used before. The total field is sampled as before. The field sampling on different pixels continues for a total of four fields. At this time, all the pixels have been sampled and an entire new sequence is started. Note again that the 7.5 Hz field is sampled in its entirety at a 2 field per second rate but the motion (we hope) looks like 7.5 Hz field rate. If there is no motion the picture looks like slow scan with the same resolution. With a slow scan 2 memory system, this sampling can be done outboard by sampling in a RAM at one fourth pixel rate which automatically stretches the sampled pulses for the reduced bandwidth. The start of the sampling in each line can be governed by a ROM that presents the start of the sampling counter relative to the master clock. We will have to decide what pseudo random sequence we will use. It won't be hard with a 4 x 4. One of our best in the laboratory with a 16x16 was when a summer student randomly hammered on keyboard setting up the sequence. We made sure that he was blindfolded before we set him down, though. Ha, ha.

The next question to be answered is what kind of transmission will be chosen for the MSTV. Theory dictates that the maximum base bandwidth signal that can be transmitted through a 36 KHz RF bandwidth is 18 KHz. Signal Sideband techniques would raise this to 36 Khz but it also adds many unknowns to the detection and generation process so FM has been tentatively chosen for MSTV.

After much testing of SSTV standards back in the 60's, the originators came up with a base bandwidth of 900 Hz and a synchronization frequency of 1200 Hz, black frequency of 1500 Hz and a white frequency of 2300 Hz. Using some of the same kind of logic that was used to determine the SSTV standards, I would like to suggest as a starting point that the following spectrum be used for further tests. If it is found later that other frequencies are more useful, it will be an easy matter to readjust the oscillators and discriminators for different standards.



The above suggested standards for transmission lend themselves to several different methods of reception. The spectrum resembles that of SSTV but it is extrapolated to accommodate the much wider base video bandwidth. The signal could be received as a widebandwidth single sideband signal if provision is made to detect the spectrum through a balanced modulator and filter. The signal can also be received as a strictly FM signal. This is also true of SSTV, but it has never been done to my knowledge on HF. My suggestion is to bring out the wide-bandwidth signal out of the spectrum analyzer output on many transceivers on the market. For instance, my FT-101 has such an output. This is the one that is brought out before the SSB filter. This low level signal can be amplified by operational amplifiers or transistors and bandwidth limited with filters, active, passive or special ones that you might find at hamfests. It does not mean that you must filter at the frequency brought out of the spectrum analyzer output. A simple mixer and oscillator circuit can translate the signal to the frequency of your favorite filter that you might have available.

The actual detection can be done in a similar manner that is done in the Robot 400. The tuned filter discriminator works very well. The frequency that some transceivers output is in the 3 MHz band. Good high frequency operational amplifiers (3100's) could be substituted for the 741 types in the Robot. Of course, the active filter elements must be redesigned for the new wide band MSTV.

The generation of the MSTV spectrum can be done in two different ways. The first is to enter the transceiver at the filter point. Close examination of the circuit of many of the transceivers show that in the absence of a CW filter that the SSB filter is wired to function. When the CW filter is purchased and installed by the owner, the shorting wires are removed and the filter functions as a bandwidth narrow filter. It would seem that at this point that a wide filter of 36 KHz could also be inserted instead of the CW filter. The circuitry supplying the MSTV signal could be built external and enter through a connection through the case.

The second method of generation of a MSTV spectrum is to remove the crystal that heterodynes the SSB signal to the band being used.

This is usually a bank of crystal oscillators that can be easily identified.

If the ten meter crystal is removed and a dual wire is run to the MSTV generator, it will not deface the transceiver in any way. This external generator can supply the original frequency for normal operation and also supply a wide bandwidth signal containing the MSTV signal. The transceiver will be operated in carrier tuneup mode. The normal SSB output will not be available simultaneously with the MSTV, of course.

Below is pictured the block diagram of the suggested circuits. I am very busy testing various versions of these circuits. If you are a serious experimenter and can do electronic design, I would encourage you to design an FM discriminator receiving system for your transceiver patterned after the ideas previously suggested. I will have operating at Dayton a simple adapter for MSTV that will convert your Robot 400 to MSTV. If you have a two memory Robot, the picture will be slightly larger; however, a single memory Robot 400 can be used and is suggested for an initial start.

I am still operating the beacon on Saturdays starting at 1200 GMT for the first ten minutes of each hour until noon (1600 GMT). At 1800 GMT, I am available on the SSTV net on 14230 Khz. I am always available for questions off frequency.

I am mailing this newsletter to all the names that I have on my list. I would like to have a response from you either in the form of self-addressed stamped envelopes or letters telling me of your work. Dayton Hamvention will give us an excellent opportunity to talk about our tests.

Dayton will have many new SSTV exhibits. Color or Colour will be the big thing. You will see several Robots hooked together, Robot 400's with 2 or 3 memories, color cameras feeding all three color pictures to a Robot setup in 1/60 second and much more. Friday night will be informal and Saturday afternoon at 2 PM will feature an hour and a half forum. W9NTP will be moderator and WØLMD will be in charge of the Friday night deal. All the information will be passed on the SSTV net on Saturdays.

If you are interested in building circuits and testing them, get in touch with one of the 6 STA hams previously listed immediately. We have no boards, just lots of messy connections on the bench, hundreds of ideas, and the enthusiastic spirit of the way Ham Radio used to be, and we hope it will be in the future. STOP BEING AN APPLIANCE OPERATOR AND START HAVING FUN WITH AMATEUR RADIO AGAIN.

SSTV WITH DAVE INGRAM

K4TWJ

Our ever changing, ever expanding world of SSTV, FSTV and MSTV truly knows no boundries. Each year's activities lead to new doors and light new paths. Less than four years ago, fast scan repeaters and digital slow scan were "ultimate" systems marking a technological milestone. Was there room for anything more? Did we have need for additional advances? Along what lines would such advances evolve? Now, even before the newness of digital scan conversion systems slackens real time color SSTV, amateur satellites with onboard SSTV and a unique narrowband motion system (medium scan) have become reality. Are more and better advancements yet lurking on the horizon of tomorrow's systems and activities? Indeed, Indeed If you're expecting situations to wane and lull, you're in for a long wait. We're living in a golden age of technical advancements and video systems of all types are a substantial part of these advancements. Enjoy! Enjoy!

One of the next possibilities rising on the horizon is what might be called ASCII in an SSTV world- - a technique first employed in the computer display area. Details of this syetem will be revelaed/discussed at the Dayton 81 hamvention. Don't miss the friday evening and Saturday afternoon forums.

Moonbounce TV is another rising possibility. Digital techniaues, along with computer processing FSK and decreasing cost of such components as GAS FETs, hot carrier diodes, and low noise amplifiers now permit any devoted TVer or EMEer to accomplish this feat. Have you noticed the digital pricing codes on foods in grocery stores? Cashiers can move these codes past a reader at various speeds and a "normalizer" handles data processing in an effecti ve manner. Thinking on this and all the other capabilities at our disposal really spurs creative ideas. Possibilities, possibilities!

Watch foe new and better SSTV color techiques, innovative ideas in MSTV and unique video processing systems for FSTV to also be revealed during the comming months. 1981 Is destined to be a banner year for video.

TVRO and MDS units have created widespread interest and enthusiasm among all levels of our society and this situation is not destined to chan change during the foreseeable future. TVRO designs and systems costs, however, are being radically altered by innovative-minded amateurs. Watch for home constructed receiving setups to hit the 300-600 dollar bracket before this time next year. Also watch for DBS, direct to home satellite broadcasting for general public use.

continued on last page of INDEX.

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	3	January 1968	9	January 1969	15	January 1970		
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Vol. 11	# 1	January 1981	Other activities: A5 has been active in FCC matters since the early 1970's including comments, petitions for rule making, and oral arguments on all amateur matters, participated for the entire five year period for WARC as an active member of the advisory committee, and continues to be present in Washington DC for all matters of importance to the whole amateur radio fraternity as well as matters of special interest to ATVers. Current efforts include SSTV operation for all phone bands by a petition for rule making submitted by KB9FO.
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	3	May 1981	
	4	July 1981	

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THIS IS NOT THE END.....

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K4TWJ continued

A few months ago I constructed one of the Universal Communications 2300 Mhz downconverter units. The converter worked substantially better than some competitive and higher priced units. The hilly terrain and heavy foilage of this area proved extremely difficult to overcome for any useful range so I began considering other applications. A concept which evolved centered around making drastic changes to the unit, adding a GasFet f ront end and ultimately feeding the resultant signal to the UHF tuner of a highly modified TV set. The finished product will be a homebrew TVRO costing about 300-350 $$. Stand by for details.

Strictly commercially speaking, we're envisioning the VTR game as a money hungry evolution similar to CB tactics. First there were crystal controlled CB's, then 23 channel synthesized and then 40 channel. VTR's were first various open reel formats, then a multiplicity of cartridge formats, then U-matic, then Beta-max, then VHS. Video disc systems are now threatening the VHS systems even before we are all equipped. Talk about economic survival! (If you would like a nice EIAJ-1 color reel to reel, Henry KB9FO has a mint Sony AV8600 with 60 hrs of movies and TV shows for sale for $400. complete with a spare head assembly. Henry has had home video tape since 1960 with every format including 2" quad broadcast machines) Fortunately, we are a technically minded group capable of understanding differences between improvements and mere changes. This asset may indeed prove invaluable during the future times.

ASCII in an SSTV world, an interesting and quite useful technique marrying ASCII and SSTV parameters is due to be unveiled at the 81 Dayton. It will surely begin hitting the airwaves soon thereafter. The basics of this conept bear a close resemblance to present computer display techniques, that is, a convention SSTV generated raster with ASCII characters of printed information inserted within the raster. We havn't circuit details at this early date, but stand by until the next iissue or so for more facts.

While enjoying our fair share of FSTV activites lately, we began combining both fast and slow scan TV with some interesting results and possibilities. This began by connecting a Robot 400 to an ATV transmitter and passing along SSTV received views to nearby non SSTV stations. Then after sucessfully woking our way through some color FSTV operations we connected a TV's video detector output to the Robot's FSTV input and FSTV relayed 20 meter SSTV with some interesting results/ We're now getting ready to set up a home-located remote system consisting of a 2 mtr FM receiver connected to the input of our Robot 400 and the FSTV output connected to the 70 CM transmitter. This is to permit local hams receiving SSTV on an HF rig to transmit the signal to the scan converter and view the fast scan TV image on a small portable TV. We've also set in motion an effort to obtain an STA to permit transmission in the UHF tv channel 82-83 region to re-transmit public interest items, such as Voyager fly-by's.

We regret to report the passing of Ray Hoare VK9RH. Ray passed away unexpectedly in January. Ray had just "got rolling" with SSTV gear sent over via the Yankee Trader. Ray was an outstanding amateur with high enthisiasm for video activities. We will be missed greatly. Additional details are sketchy at this time, however we understand that another Norfolk ham has volunteered to continue Ray's SSTV activty.

On the good side of the news, WØDO's XYL is reported successfully recovering from cancer related treatments. Lee passed alsong this good news on the SSTV net with special thanks to all SSTVers sending cards and adding personal concerns in this lengthy battle. Congratulations to WØDO and XLY for "beating" the cancer threat.

Isreal Radio's second SSTV broadcast was conducted at 0200 GMT and 215 GMT on Feb 15th. The results were good. The views were slightly better than the first SSTV broadcast and DX corner program emcee Ben Golson did an exceptional job of explaining each view. The next broadcast is not scheduled, but keep listning to Isreal Radio on 7412Khz on Sunday nights (US time).

Before wrapping up this months column, I would like to encourage each one of you to write to me and let me know what your interests are. Be it A5, FSTV, MSTV, SSTV, TVRO, MDS, VTR, RTTY, equipment, uses, activities, how or whatever you want to know about. Any interest in DX or OSCAR or EME? Let's hear from you about your ideas, A5 is YOUR MAGAZINE and we can only publish waht you send in and can only provide material on the areas you want covered, so let us know. Write, Dave Ingram K4TWJ, Eastwood Village # 1201 S, RT 11 Box 499, Birmingham, AL 35210. 73 BCNU.

IMAGE-21

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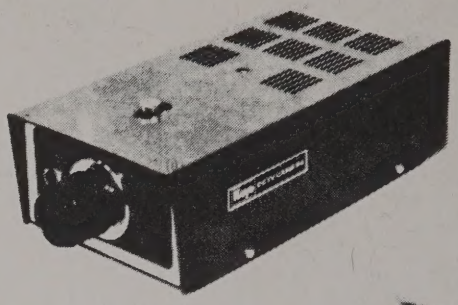

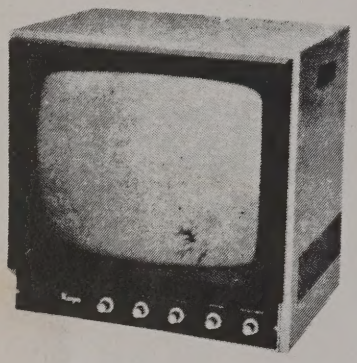

PARTIAL LISTING of CAMERAS and MONITORS:

Hitachi HV-62 2/3" general purpose camera, 500 lines, ALC, line lock, F1.6 lens.....$235.00

Hitachi HV-62S 2:1 interlace camera, 550 lines, ALC, white suppression.....$326.70

Hitachi GP-5 color camera w/6:1 zoom lens and electronic viewfinder.....$1195.00

Hitachi VM-910 9" 500 line monitor.....$216.00

Koyo TVM-90 9" 600 line monitor.....$194.00

Koyo MV-12 12" 700 line monitor.....$320.00

Sony/Image-21 custom color rcvr-monitor.....$715.00

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